

# THE MONIST

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## ORIGIN OF THE MARINERS' COMPASS IN CHINA\*

THE reign of Ch'öng-wang (B. C. 1115-1079) has been quoted by Chinese and foreign authors alike as being the period during which the north-, or as the Chinese say, south-pointing qualities of the magnetic needle were discovered. In the sixth year of his reign, so the legend runs, Ch'öng-wang received the news that the ambassadors of a distant foreign kingdom, called the tribes of Yüé-ch'ang, had arrived with presents to do him homage. They were at home in the south of the country of Kiauchi, i. e., the present Tungking. Later Chinese historians placed them at the very spot where, during centuries at the beginning of our era, the embassies from India (T'ién-chu) and Syria (Ta-ts'in) disembarked, in order to be conveyed to the Chinese Court, and where, according to the *Shui-king-chu*, a geographical record of the fifth century A. D., ships used to start for the journey south to the countries of the Malayan Peninsula. This place clearly marks what may be called the terminus of Western navigation as described on the Chinese side, which is probably identical with Ptolemy's city of Cattigara, the terminus of shipping enterprise in the Far East according to western classical authors. The emperor gave orders that the Yüé-

\* From the author's lectures on the History of China, delivered at Columbia University, New York.

ch'ang ambassadors should be conducted to the court and that great honor should be paid them. The ambassadors were accompanied by interpreters speaking different languages and brought pheasants and the tusk of an elephant as tribute. Since they were in doubt as to how to find their way back to their home, the Duke of Chóu, the Emperor's uncle and prime minister, is said to have presented them with five chariots provided with a south-pointing contrivance (*ch'í-nan-kü*, i. e. "south-pointing chariots"). Thus they found their way back "to the seas of Fu-nan and Lin-i," the last named country, well known during the Han Dynasty, containing the territory from which they had come, as Legge (*Shu-king*, p. 535, *seq.*) has pointed out.

No trace of this embassy and the south-pointing chariots mentioned in connection with it is contained in the *Shu-king* and the *Sh'í-ki*. Legge, therefore, looks upon it as a myth. Nevertheless we possess early traces of the belief in such an invention, as being made, if not by Chóu-kung, at least by some one among the old rulers. The philosopher Han Fei, who died in 233 B. C., says in one of his essays (*Han-fei-tz'í*, chap. 2, p. 4): "The early kings constructed the *ssí-nan*, i. e., 'the south-pointer,' in order to fix the position of morning and evening." And a still earlier philosopher, Kui-ku-tz'í, who lived in the fourth century B. C., refers to the people of Chōng (K'ai-fōng-fu) as having made use of the "south-pointing chariot" (*ssí-nan-kü*), when sending for jadestone (s. *Kui-ku-tz'í*, sec. 10 of his book). Kui-ku-tz'í, whose little work is not completely preserved, is also quoted in the *T'ai-p'ing-yü-lan*, a cyclopedia of the tenth century, as having said:

"The Su-shōn (which is the same name by which, many centuries later, the Nü-chōn, Ju-ch'í, or Djurdjen Tartars, the Tungusic ancestors of the Manchus, were known, but in this case probably represents an unknown barbarous tribe somewhere near the Chinese dominion mentioned in

the *Shu-king*, Legge, p. 12, par. 56) offered a white pheasant to Wön-wang. Lest they might lose their way on the journey, Chóu-kung constructed the 'south-pointing chariot' to accompany them" (Legge, *Shu-king*, p. 537).

Possibly Wön - wang and Ch'öng - wang were confounded in this passage. Kui-ku-tzi's text contains yet another passage (p. 4B), in which he speaks of "loadstone attracting a needle," but since this need not necessarily involve a knowledge of the magnetic compass, I would lay no stress on it. From all this it would appear that as early as the fourth century B. C. some sort of a contrivance indicating southern direction either existed or was believed to have existed formerly. In the later literature, the term *ch'i-nan* (from *ch'i*, "to point with the finger," and *nan*, "south," and identical with *ssi-nan*) is occasionally used metaphorically, for instance in the History of the Three Kingdoms (*San-kuo-chi*: Shu, chap. 8, p. 4B), from which it would appear that the term was quite current in the sense of "a guide" about the year 200 A. D. Yet we have no indication whatever to show what the south-pointing chariot, or *ch'i-nan-kü*, was in reality. We do not hear of the magnetic needle being used as a compass in connection with it any more than on board ship for several centuries after the downfall of the Chóu dynasty, and if the needle was at all at the bottom of those chariots, the invention of which was attributed to the Emperor Huang-ti in one, and to Chóu-kung in another passage of the *Ku-kin-chu*, a work of the fourth century A. D., we possess no record showing how they were constructed. From an account of the history of this invention contained in the *Sung-shu*, a historical work of the fifth century (chap. 18, p. 4) it appears that the secret of the "south-pointing chariots" had been lost for many centuries, when the eminent astronomer Chang Hōng, who died in 139 A. D., reconstructed it. In the troubles causing the downfall of

the eastern Han dynasty his model, too, was lost and consequently forgotten.

Since the third century A. D. renewed interest began to be taken in these mysterious allusions of the ancient literature, which led to repeated attempts to reconstruct what the would-be reconstructors apparently mistook as a mechanical contrivance, and it appears that all that was turned out was a machine consisting of certain wheels, possibly registering the movements of the axle of a chariot in such a manner as to cause an index hand to point in the same direction, whatever direction the chariot might take. I do not know whether such a construction is actually within the range of possibility; if so, I would be inclined to think that these re-inventions were used as mechanical toys to be kept in some Imperial museum as models supposed to correspond with Ch'ou-kung's chariots and doomed to oblivion as being practically useless. I find it stated in the *Sung-shu*, to which account Prof. H. E. Parker has drawn attention in the *China Review* (Vol. XVIII, p. 197), that certain models made under instructions from Shi Hu, the emperor of a short-lived foreign dynasty in the middle of the fourth century, and from Yau Hing, an emperor of the later Ts'in dynasty (about 400 A. D.), fell into the hands of the Sung Court in A. D. 417, but "the machinery being too coarse, the south-pointer showed so often in the wrong direction that men were required to set it aright again." Subsequent attempts are spoken of as having been more successful, but as I understand the *Sung-shu*, the author of this account thinks of "machinery" and is not aware of the real agent, although he casually remarks that, during the Tsin dynasty (265-420 A. D.) there was also a *ch'i-nan-ch'ou*, i. e., "a south-pointing ship." The Emperor Yau Hing's contrivance is more clearly described in the biography of its engineer (*Nan-ts'i-shu*, chap. 52, p. 15), which says it had no machinery at all, but that,



whenever it was put in motion, a man had to step inside to move the apparatus. Trying to read between the lines, I am inclined to assume that this remark strongly suggests the use of a compass, the man who had to step inside giving the chariot the direction ascertained from it. Yet we find in the *Sung-shū* (chap. 149, p. 15) the detailed description of the model of a "south-pointing chariot," seriously submitted to the Emperor Jön-tsung as late as 1027 A. D., based on a most complicated system of cogged wheels, diameters and numbers of cogs being given, and said to have been originally constructed about 806 A. D. A similar machine, also described in the *Sung-shū*, was constructed in 1107 A. D., when it was submitted to the Emperor Hui-tsung. At this time we can, from other sources, show reason that the magnetic needle must have been well known, if not as a guide to mariners, at least as an instrument seen in the hands of geomancers for centuries before that date. Dr. Edkins, in his paper "On Chinese Names for Boats and Boat Gear," quotes Mr. Wylie in showing that the Buddhist priest and Imperial Astronomer I-hing at the beginning of the eighth century knew not only the south-pointing qualities of the magnetic needle, but also its eastern deviation (*Journal of the China Branch, Royal Asiatic Society*, N. S., Vol. XI, p. 138). Since no references are given, I am not able to confirm the fact, but I am certain that the deviation of the needle was well known in China about the year 1115 A. D., when it was described in the *Pön-ts'au-yen-i* (quoted in the *Ko-chi-king-yüan*, chap. 49, p. 12B). It was then stated that, if you rub a needle with loadstone, it will point to the south, but that it will always deviate a little to the east and not show due south. To prepare the contrivance one had to single out a fine thread from a new skein of silk floss and fix it with half a candareen of bees' wax on the middle of the needle, the latter to be hung up where there was no wind. The

needle would then always point to the south. By sticking the needle through a piece of lamp wick (which in China is made of pith) and thus causing it to float on the water, it would also point to the south with a slight deviation, which the author tries to explain from the mystic point of view of Chinese natural philosophy. Shön Kua, who wrote about the middle of the 11th century, gives us a still clearer account of the contrivance, which according to his own words was used by the *fang-kia*, or geomancers, and he says absolutely nothing about its use in navigation. He also describes the deviation of the needle, without any attempt at explanation. For, "the reason, why loadstone points to the south, just as cypresses point to the west, cannot be explained" (*Möng-k'í-pi-t'an*, chap. 24, p. 7B). Since Shön Kua was a native of Hangchow, where lively traffic existed in those days with Arab and Persian traders, it seems quite possible that the latter have seen the needle used for geomantic purposes somewhere in that neighborhood, if not in Chinchew (Zai-tun) or Canton, learned the secret of its preparation from the Chinese and discovered its further use in navigation.

The *Ch'au-yé-ts'ién-tsai* (a work of the eighth century A. D. quoted in the *Ko-chi-king-yüan*, chapter 29, p. 25) states that in 692 A. D. a mechanic was sent to court from Hai-chóu, a seaport on the coast south of Kiau-chóu (Shan-tung), who had constructed a "chariot showing the twelve hours of the day" (*shí-är-ch'ön-kü*) by the shaft being turned due south. It looks very much as though the magnetic needle had something to do with it, too. It may have been a mechanical toy to be used indoors, somewhat like another "south-pointing chariot," so styled and described on the preceding page of the cyclopedia referred to as being only seven and a half inches long and about fifteen inches high, and not a chariot in the ordinary sense.

The earliest unmistakable mention of the use of the magnetic needle as a guide to mariners I have been able to find in Chinese literature, is probably as old as the knowledge of its use in Europe. It occurs in a work of the twelfth century, entitled *P'ing-chóu-k'o-t'an* and compiled by one Chu Yü, a native of Hu-chóu in Chö-kiang. In the second chapter of this work the author has inserted a series of notes on the foreign trade at Canton, which, previous to the arrival of the Portuguese in Eastern waters, was in the hands of Arab and Persian navigators. Since, from what we know of the author's lifetime, he has never himself lived at Canton, whereas his father, Chu Fu, had held office there at the end of the eleventh century, the critics of the great Catalogue of the Imperial Library at Peking (*Ts'ung-mu*, chapter 141, page 15 *et seq.*) hold that his information about the foreign trade in Canton is based on accounts of Chu, the father, and that it, therefore, dates from the latter part of the eleventh century A. D. This view is supported by the fact that the years A. D. 1086 and 1099 are mentioned in Chu Yü's paragraphs referring to Canton in other connections. Among these interesting notes I find (chap. 2, p. 2) one referring to the foreign ships by which trade was carried on between Canton and San-fo-ts'i (Palembang) on the coast of Sumatra and farther on to the ports in Arab countries, including India. It runs as follows:

"In clear weather the Captain ascertains the ship's position at night by looking at the stars, in the daytime by looking at the sun; *in dark weather he looks at the south-pointing needle (chü-nan-chön)*. Sometimes he will make use of a rope, ten chang in length, to hook up mud from the bottom of the sea, the smell of which will tell him where to go to. In the open sea there is no rain, and when it rains, they are nearing land," etc.

The wording of the passage is of such a kind that it

does not give us any clue whether the Chinese at the time were, or were not, familiar with the use of the compass on board ship. I am inclined to think, however, that attempts to use the needle on board must have been made in China about as early as it was known there to geomancers, but that it was abandoned as a useless luxury by the conservative junk masters, who were accustomed to steer their ships by taking bearings and soundings and scarcely ever required a compass for their coasting trips. Navigation on the high seas in those days was in the hands of foreigners (Arabs and Persians), and this may be the reason why we first hear of them as having turned the old Chinese invention to practical use on shipboard.

We have seen that, apart from the great probability of the magnetic needle being known in high antiquity, instances are on record of its being used during the middle ages for geomantic purposes. If my assumption that the magnetic needle was seen by Arab traders on the coast of China in the hands of geomancers, applied by them to navigation and then brought back to China as the "mariners' compass," proves correct, the history of this invention may be looked upon as perfectly analogous to that of gunpowder, the preparation of which was probably known to the Chinese long before they learned its application to fire-arms through Europeans.

#### ABSTRACT OF DATES.

- B. C. 2704-2594. The invention of the "south-pointing chariot" ascribed to the legendary Emperor Huang-ti according to the *Ku-kin-chu* (4th cent. A. D.).
- B. C. 1231-1135. "South-pointing chariots" were presented by Wön-wang to certain ambassadors. The passage, which may be wrongly handed down, is contained in the *Kui-ku-tsi*, a work of the fourth century B. C.
- B. C. 1115-1079, under Ch'öng-wang. Legend of the arrival of ambassadors from the south, conducted home by the aid

of "south-pointing chariots." No indication is on record to say what these were. The entire account is legendary and not backed by contemporaneous records.

- B. C. 4th Century. The philosopher Kui-ku-tzī speaks of the "south-pointing chariot" as being used by the people of Chōng. He knows that loadstone will attract a needle.
- B. C. 233. The philosopher Han Feī speaks of a "south-pointer" by which the position of east and west may be ascertained.
- A. D. 139. The astronomer Chang Hōng tries to reconstruct the old "south-pointing chariot." His model, however, became lost and forgotten.
- A. D. 200. The term *chī-nan* ("south-pointer," or "compass") is used figuratively in the sense of "a guide." *San-kuo-chī*.
- A. D. 350-400. The Emperors Shī Hu and Yau Hing are in the possession of apparatuses pointing south, but the "machinery" being coarse, they point wrong (*Sung-shu*), and in Yau Hing's contrivance a man is required to move it (*Nan-ts'i-shu*).
- A. D. 265-420. "South-pointing ships" (*chī-nan-chōu*) are mentioned.
- A. D. 692. A south-pointing contrivance showing the hours of the day is invented.
- A. D. 700. The Buddhist astronomer I-hing is familiar with the eastern deviation of the magnetic needle. Edkins, quoting Wylie. Wylie, in a paper entitled "Magnetic Compass in China," reprinted in *Chinese Researches*, (Shanghai, 1897), p. 155, says:
- "A passage from the life of Yih-hing, a Buddhist priest and imperial astronomer at the commencement of the eighth century, will show that the subject had engaged attention at least 900 years earlier [than the seventeenth century]. It is said, that 'on comparing the needle with the north pole, he found the former pointed between the constellations *heu* and *wci*. The pole was just in 6 degrees of *heu*, from which the needle declined to the right (east) 2° 95'. As it declined to the right of the north pole, it was neces-

sarily to the left of the south pole.'” I have not succeeded in finding this passage in the lives of I-hing I was able to consult, but take it for granted on the excellent authority of the late Mr. Wylie that it is contained in some other Chinese text, which I hope to be able to hunt up some day. Unfortunately neither Mr. Wylie nor Dr. Edkins have given us chapter and verse of this passage so very important in the history of our subject.

- A. D. 806. A south-pointing contrivance consisting of cogged wheels is said to have been constructed in the *Sung-shi*.
- A. D. 1027. A “south-pointing chariot,” described as a mechanical contrivance, is submitted to the Emperor Jön-tsung. *Sung-shi*.
- A. D. 1030-1093. Lifetime of the encyclopædist Shön Kua, who speaks of the magnetic needle and its deviation as used for geomantic purposes.
- A. D. 1100, or sooner. Probable first unmistakable mention on record in Chinese literature of the “south-pointing needle” on board ship as being used by foreign (Arab and Persian) navigators at Canton.
- A. D. 1107. A “south-pointing chariot,” also described as a system of cogged wheels, etc., is submitted to the Emperor Hui-tsung.
- A. D. 1115. The magnetic needle is described in detail and its deviation mentioned in the *Pön-ts’au-yen-i*, where no allusion is made to its use on board ship.

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## PROFESSOR MACH'S PHILOSOPHY.

**A**MONG our contemporary thinkers Prof. Ernst Mach is distinguished by independence and exactness of thought and an absolute absence of pretension which with all his prominence in the history of science renders him pretty nigh one of the most amiable men in the world. He has crowned his life's work by a new volume, entitled *Cognition and Error*,\* in which he discusses methods of scientific enquiry and points out the sources of error. Professor Mach is original in the sense that he does not rely on others but goes his own way. He has been influenced by great thinkers in both philosophy and physics, but he has not become the disciple of any one of them, and we would say that the main points on which he insists are, first, his distinction between theory and fact, and secondly, his observation of the *modus operandi* of science itself which he finds in an economy of thought. This economy leads to simplification finally implying a system of monism, and in this sense Mach may be called one of the leading monists whose theory, however, is tentative and empirical, not dogmatic or metaphysical.

Mach's aim from the beginning has been to eliminate the many errors and implications that arise from a wrong conception of our intellectual tools. Theories are frequently regarded as the main thing, and facts as incidentals,—in consequence of which theories are looked upon

\* *Erkenntniss und Irrthum*. Leipsic: J. A. Barth, 1905.



as ontological principles and constitute the basis of all metaphysicism which has been dominating in both philosophy and science.

As soon as I became acquainted with Mach's works, I at once recognized in him a kindred spirit, and my admiration has only increased by personal acquaintance. I am proud to count him among my dearest personal friends. There are no doubt differences between Mach's views and mine, but they are due, so far as I can see, to Mach's (in my opinion exaggerated) anxiety not to lose in his science from under his feet the *terra firma* of concrete facts.

Professor Mach looks, so far as I can see, with too much suspicion upon theories in every form, and compares them to the scaffolding of a building in erection. The scaffolding has to be taken down, as soon as the building is completed. He further criticises the mechanistic view,—that theory which would resolve all the different sciences into mechanics,—as insufficient and one-sided, a proposition to which I agree but not without considerable modification and for other reasons than his as well as with different objections.

I had some controversies on these points with Professor Mach, but I have not succeeded either in converting him to my view, nor have I been convinced by his reply. I had hoped at any rate for a mutual understanding by which our disagreement would either be reduced to verbal differences, or its source and significance be discovered, but in some way or another I have not succeeded, and our readers might deem it an open question whether there are points in which I have misunderstood Professor Mach, or whether in spite of all agreement, we face a radical difference in our philosophical conception.

Now Dr. Kleinpeter, one of the most ardent and most accomplished disciples of Professor Mach, presented a condensed statement of Professor Mach's monism, in the

April number of *The Monist*, and I find that in pointing out the uniqueness of Professor Mach's standpoint, he includes among others my own philosophy as noticeably different from his. Whether or not this is so ought to be decided by Professor Mach himself, but being anxious to understand him, as well as to point out why and how I differ from him, I wish to devote to this important subject a few comments.

I have always endeavored to work out a philosophy that should be objectively acceptable to all as much as is any science. Philosophy as a science, or in other words the philosophy of science, is the great desideratum of the present age. In order to attain my aim I have carefully endeavored to eliminate the personal equation which philosophers so easily introduce into philosophy by their ambition for originality. At the same time I have tried to understand other philosophers, not in their errors according to literal interpretations, but in the truth which they intended to bring out. The intention of a philosophy is its spirit, and many drawbacks in the systems of the past are due to awkwardness, perhaps also to the fact that standpoints have been taken in contrast to errors of their age, and I find, when trying to be just toward other philosophers, that there is more agreement in the philosophical world than is generally thought. Even in my present differences with Professor Mach, I still feel the confidence that we mean the same, and where I may appear radically opposed to his views, especially as understood by Dr. Kleinpeter, I am convinced that Dr. Kleinpeter is only not sufficiently familiar with my exposition, and that he misunderstands it because he does not fully appreciate the object which I have in view, and which, so far as I can see, is only more comprehensive than are Mach's expositions, and will help to explain his theories on the economy of thought. On the other hand, Dr. Kleinpeter insists,

as it seems to me, more vigorously than Mach himself on those points which I deem the weak spots of Mach's views.

Dr. Kleinpeter makes too much of a passage in Mach in which, with reference to the difference between the reasoning of the philosopher and the scientist, he speaks not without irony of the fortunate position of the philosopher who possesses unshakable principles, while the naturalist considers even his best-founded views as provisional.

Dr. Kleinpeter claims it as quite original for Mach that to him there is only one kind of reasoning. Though there are a few philosophers who think that there is a difference between philosophic and scientific cognition I do not think that either Aristotle or Kant would have made that distinction; and as to myself I will in this connection call attention to a controversy I had with Professor Jodl on this subject\* in which some years ago I insisted on the very same point, and claimed that there was no philosophical reasoning different from that of the scientist. Like Mach, I go further and claim that the scientist's view is nothing but common sense only more refined by exactness and punctilious attention to detail. More than that, all thinking is but the conscious tracing of the processes which build up the subconscious foundation of our mind, being kin to other natural phenomena not only in the animal world but even in inorganic nature.

Dr. Kleinpeter italicizes the statement that "Mach's monism is not a monism of system, but a monism of method." If this is meant in contrast to all other conceptions of monism, including my own, I wish to call his attention to the fact that this is an important point I have been insisting on since I have become a defender of the unitary world-conception. I will only make one quotation

\* *Surd of Metaphysics*, pp. 101-115. Republished from *The Monist*, II, pp. 235-238.

which I select from my *Primer of Philosophy* (Introduction, p. 4) where I say in almost literal agreement: "Monism is not a finished system, but a reliable plan for a system." I have always rejected all those monistic conceptions which would establish a unity of the world by reducing it to one abstraction, either of matter, or of spirit, or of any other generalization. I have taken pains to explain that all these abstract ideas are not realities, but thoughts (abstract generalities), and that the unity of the world has to be derived from that obvious feature of experience which allows the methodical systematization of knowledge. Whether or not the world consists of one substance or possesses also an external unity, is another question of which I deem an affirmation probable but as yet unproved. The main thing is that there is no duality in the conception of the world, and all truths must finally form one consistent system of truths. If there is any difference between Mach and myself, I might claim having paid even more attention to this particular point, and having more vigorously insisted on it, than he.

Professor Mach's monism is the result of his methodology, and his methodology is based on the experience that science is economy of thought. I agree perfectly with him on this subject, and I believe that he has not had a more appreciative reader of his expositions than myself. He has treated this particular subject with an unprecedented mastery, yet it would be a mistake to say that he is the only, or even the first, scientist who has recognized this point. Mr. Thomas J. McCormack has collected a number of remarkable passages from Adam Smith on the very same subject\* which prove that consciously and unconsciously other people have had the same thought. It is perhaps natural, and most assuredly interesting, that an economist should be more appreciative of the value of

\* "An Episode in the History of Philosophy," *The Open Court*, IX, 4450.

economy of thought than philosophers, but it is sufficient to prove that the idea is not as unique as Dr. Kleinpeter thinks, although I am fully convinced that the way in which Mach handles the subject proves the originality of his mind.

While I have no objection to Mach's description of science as economy of thought, I would hesitate to say that it is sufficient as a definition, because science is a correct (or adequate) description of facts in their essential features. Exactness, correctness, adequacy, truth, or whatever you may call it, is the main thing, and comprehensiveness comes in second as a natural consequence whenever the essential features have been rightly understood. Economy of thought again is due to comprehensiveness; and so in our conception economy of thought, which undeniably is a significant characteristic of science, can by no means be regarded as a sufficient description of science, or even its most essential quality.

We are told by Dr. Kleinpeter that "it is characteristic of a system that it begins in some slight self-evident proposition and descends from these to particulars," and that "Mach's method" is "exactly the reverse." Since the term "system" is also meant for my conception of monism, I wish to call Dr. Kleinpeter's attention to the first chapter in my *Fundamental Problems*, on "Ontology and Positivism" in which I point out the contrast of my monistic positivism to Hegel's ontology. While Hegel starts from the abstract and comes down to the concrete, I start from the concrete and explain the nature of the abstract as having risen from concrete facts. And our abstractions have been invented for nothing else (as Schiller once declared) than to give us a survey over the domain of facts.\*

The difference between myself and Professor Mach

\*For the elucidation of this point, I translated and quoted Schiller's splendid little poem "The Metaphysician" in *Fundamental Problems*, p. 77.

as to the part which economy plays in the realm of thought is mainly this: that while Professor Mach appears to rest satisfied with using it as a principle that has so far worked well in experience, I try to explain why economy of thought is possible at all, and my explanation is based on the idea that theory is not a purely subjective device to deal with experience, but that there is a feature in experience itself which justifies the formulation of theories. This feature is conditioned neither by energy nor by matter (which are the abstract terms for the concreteness of the world as experienced by resistance), but it is of a purely relational, i. e., a purely formal, nature. The purely formal is characterized by an absence of concreteness, a negative feature which, however, (as is the case with all negative magnitudes) is not without a positive application. In my articles on mathematical space I have defined it as "any-ness," which implies generality, and experience proves that the generality of the purely formal can be relied upon in the domain of concrete objectivity. Accordingly the purely formal is not merely a matter of method, it is not purely subjective, but must be a feature of the objective world.\* It explains why there are uniformities. In other words the purely formal (Kant's *a priori*) is not as Kant says purely "ideal," but it is also objective. Numbers, curves and other *a priori* constructions can be employed as systems of reference for determining features in analogous instances of experience.

This is a justification not only of the objectivity of form and formal relations, but also of their correct representation in the purely formal sciences (Kant's *a priori*). It is more than likely that Professor Mach would object to the term *a priori*. Nevertheless he accepts confidence in it for a *a priori* means nothing but beforehand knowledge, i. e.,

\* For details I must refer to the articles in question, "The Philosophical Foundation of Mathematics," *The Monist*, XIII, 273; "The Foundations of Geometry," *ibid.*, 370, 493.

the possibility of knowledge in certain lines of argument by reflection, pure thought, mere theory (call it by whatever name you please) even before we have had an experience thereof. Such is Kant's own explanation as stated in the beginning of the *Critique of Pure Reason*.

Professor Mach (as quoted by Dr. Kleinpeter) speaks of the essence of science as "a means by which we are spared direct experience." That is an unequivocal recognition of the *a priori* as a working principle.

There are two kinds of theories, first such elucidations of a group of unexplained facts as render it intelligible by comparing it to another group of facts that is well understood. The theory of an electric fluid is a good instance. Such theories are mere scaffolds which (as Mach suggests) will have to be taken down as soon as we know the actual state of things. They are mere similes, helpful so long as we know no better, but they may become hindrances to progress if not distinguished from facts. However, there is another class of theories which consists of uniformities, viz., generalized descriptions of groups of facts, and they are not merely temporary scaffolds, they are the real stones of the building of science itself.

According to Professor Mach there is no difference between purely formal and material, between *a priori* and *a posteriori*, and I shall possibly agree with him in the sense in which he means it, for I do not deny that ultimately everything is derived from experience. Yet there is a contrast between the purely formal and the material; there is a difference of method between purely mathematical investigations and chemical experiments. Much depends on words, for we may or may not limit the term "experience" to sense-experience only.\* The truth remains that all mathematical and logical truths are the results of an inner experience called reflection, and in performing purely

\* Compare my *Primer of Philosophy*, p. 26 ff.



formal operations we omit all reference to either matter or energy, the main features of objective reality, and limit our attention to the purely relational.

While purely formal thought constitutes a field of its own, I have insisted on the fact that it does not stand in contradiction to experience. Sense-perception and the purely formal sciences are ultimately derived from the same source. The latter are purely mental constructions, yet the principles and general conditions of mathematics, including geometry and algebra, logic, etc., have been quarried, as much as sense perceptions, out of the mine of experience. There is nothing that has not, directly or indirectly, been derived from experience, but the characteristic feature of the purely formal sciences in contrast to the natural sciences resting on sense-perception is exactly this,—that the former are purely mental constructions built up in the abstract domain of anyness. I grant that mathematics is absolutely true only in the field of its own premises (mathematical space), but there is in it a feature which makes it universally applicable, and we have only to modify it by considering the special conditions to which it is applied.

Further, does not Dr. Kleinpeter exaggerate the significance of Mach's proposition that "sense-perceptions, not objects, are the subject-matter of the scientist?" Is not the definition of object as a bundle of sense-perceptions widely accepted? The first sentence in the chapter entitled "Definitions and Explanations" in my *Fundamental Problems* (p. 254) states the same truth as follows: "The data of experience are perceptions." It is quite obvious that the difference between the psychologist and the naturalist is merely, as Mach says, a difference of standpoint, or as I would express myself, a difference of the object in view, a difference of purposes.

In spite of these agreements between Professor Mach

and myself I know of some differences—especially those concerning which we had some controversy. Professor Mach regards the whole of reality as sense-perception, and deems the distinction made between objects and sense-impressions inadmissible. To him sense-impressions contain the whole of reality, and science has nothing to do but to analyse and elucidate sense-perceptions. It seems to me that there must be here a difference of nomenclature, and I would think that Professor Mach in speaking of the sense-perception of a star, includes with it the star itself and the whole immeasurable depth of celestial space which according to our scientific knowledge the light of the star has to travel. Professor Mach has informed me that such is not his view. His idea of sense-perception is simply sense-perception and nothing more.

Professor Mach explains the origin of his views in a footnote on page 23 of his *Contributions to the Analysis of the Sensations* where he says:

"I have always felt it as a stroke of special good fortune, that early in life, at about the age of fifteen, I lighted, in the library of my father, on a copy of Kant's *Prolegomena zu jeder künftigen Metaphysik*. The book made at the time a powerful and ineffable impression upon me, the like of which I never afterward experienced in any of my philosophical reading. Some two or three years later the superfluous rôle played by the "thing-in-itself" abruptly dawned upon me. On a bright summer day under the open heaven, the world with my ego suddenly appeared to me as *one* coherent mass of sensations, only more strongly coherent in the ego. Although the actual working out of this thought did not occur until a later period, yet this moment was decisive for my whole view. I had still to struggle long and hard before I was able to retain the new conception in my specialty. With the valuable parts of physical theories we necessarily absorb a good

dose of false metaphysics, which it is very difficult to sift out from what deserves to be preserved, especially when those theories have become very familiar to us."

Mach's book *Contributions to the Analysis of the Sensations* is the result of the experience here related. If the whole world consists of sensation, the work of science can only be an analysis of sensations.

Without finding fault with Professor Mach's views, I would say that I prefer to state the same truth in a different way. Professor Mach speaks of "sensations" as "the elements of the world," while I call "sense-perceptions" "the data of experience." I do not hesitate to say that the data of experience (i. e., the sum total of our sensations) is the basic portion of our subjective existence, and the rest of it, our ideas, abstract thoughts, etc., is a mental construction built from the material furnished by sensations. The domain of thought has been worked out to serve as a picture of the objective world, or in other words it is meant to denote the conditions which determine the different states of our subjective existence. Professor Mach thinks that sensations alone are real and that our ideas are purely mental symbols, but I beg to differ. I am perfectly aware of the subjective nature of our mental constructions, but I claim that they have objective validity. They are not purely subjective reconstructions of what we call things and the interrelation of things. I endorse Mach fully when he describes our thoughts as an imitation or remodeling of the facts (*ein Nachbilden der Thatsachen*) but I would not limit the meaning of the word "fact" to sensations, which alone are said to be real and the elements of the world. I would include under the term also and especially those objective factors which we assume to be the external causes of our sensations. Whether or not things are such as we conceive them to be is not the question here. We only say that things as they appear to our

senses give evidence of a reality not ourselves which we call objective; and our mental picture of this reality may be correct or incorrect, true or false, adequate or inadequate, according to our power of verifying our anticipations. If I see an after-image and try in vain to take hold of it with my hand, I conclude that the after-image is an illusion, which means that I deny its reality. If I have a wrong idea concerning the nature of certain things, my anticipations will be disappointed, and I shall have to grant that I was mistaken. But if my anticipations do not disappoint me, the object is called real. If my calculations based upon exact observations prove reliable, I am entitled to think that they were correct. Truth is adequacy of representation with reference to the thing represented, and the only test of truth to be had is a justification by experience.

One characteristic feature of experience is a general consistency of facts which may popularly be expressed in the statement that nature is uniform. The uniformities of nature, commonly called natural laws, do not contradict one another.

Mach's definition that sensations are "elements of the world" is true from the subjective standpoint, but our own experience teaches us that the subject originates and passes away. The elements of the subjective world are not the elements of the objective world, though we may say that the elements of our knowledge of the objective world are sensations, or better sense-impressions, made upon the subject by an unknown reality. Mach's definition of "sensations" as "the elements of the world," is a misnomer; he ought to define it as "the elements of *our* (i. e., the subject's) world."

We would further say that the data to be analysed are not exactly sensations but perceptions. It is a well-known psychical truth that man is not conscious of the sense-

element of his sensations, but of the result such as it appears when worked out by the mind. This result of sense-impressions is called perception. If I see a sparrow seated on the window sill, I do not see a little brown speck on my retina, but I see a gray bird; in other words, I am conscious of the result and not of the elements into which a psychological and physiological investigation analyses my perception. And this is so true that our sense-perceptions are sometimes vitiated by ideas associated with kindred sense-impressions. Hallucinations or counterfeit perceptions are produced with such vividness that the sensation is forever afterward adulterated by its association, so as to render a reliable analysis of its recollection absolutely impossible.

I have never lost sight of the truth that not things, but our perception of things, are the data of experience. To me this proposition is a tautology, for it simply means that the world of our subjectivity is subjective. But for that reason I would not say that the world itself is subjective too. While "*our* world" is made up of sense-elements, "*the* world" is different, and in contrast to subjective existence we call it "the objective world."

It is a traditional fault of idealists (who, however, had better be called subjectivists) to identify the subjective world with the entire world including its objective aspect. One of these idealists is Schopenhauer, and through him I became for the first time intimately acquainted with idealism. Idealists as a rule when understanding the truth of the proposition that our world consists of sensations, forget that the idealist view is one-sided and must find its completion in a proper comprehension of the nature of the objective world.

The contrast is well described by Schopenhauer, who characterizes Goethe as a realist (or we had better say "objectivist") incapable of understanding the subjectivism

of Schopenhauer's idealism. Schopenhauer met Goethe at Weimar, and mentions the following incident:

"This Goethe is so entirely a realist that he could not get it into his mind that objects as such existed only in so far as they were conceived by the thinking subject. 'What,' said he once to me, gazing at me with his Jupiter eye, 'light should only be here in so far as you see it? No sir. You would not be here if the light did not behold you.'"

Obviously both Schopenhauer and Goethe are right, and each one expresses one aspect of the truth. Objects, *qua* objects, are mere bundles of sensations and the objective world as it is conceived by man's mind is a picture woven of sensation and thought. So far Schopenhauer is perfectly right, but that something which is represented by these sensations is not a mere dream. It is what is commonly called reality or the objective world, and this objective world is the foundation from which the subjective world is a mere temporary and transient reflection. Accordingly, Goethe is right (just as much as Schopenhauer) when he contends that man and his eye would not exist unless the light did behold him and thereby had produced his vision. Schopenhauer means by light a psychological function, while Goethe means an objective process, viz., the ether waves which produce those wonderful color sensations on our retina. The eye would never have developed in a world without ether waves.

That Goethe was neither so one-sided nor so philosophically crude as Schopenhauer thought, appears from his well-known aphorism:

"Were not the eye to the bright sun akin,  
It never could the light see shine,  
And did not God dwell thus our soul within,  
How could with rapture thrill us the divine?"

"Wär' nicht das Auge sonnenhaft,  
Die Sonne könnt' es nie erblicken.  
Läg' nicht in uns des Gottes eigen Kraft,  
Wie könnt' uns Göttliches entzücken!"

I am faced by the dilemma that either Mach has strained a point and we must not take him seriously, or that he is an idealist or, as we would say, a subjectivist.

The other point where I cannot follow Professor Mach is his objection to mechanicalism. I must confess that I myself am not a supporter of the mechanistic theory of the world in the sense in which Professor Mach criticizes it. There are philosophers and scientists who believe that the whole world can finally be explained by matter and motion, and that all the sciences can ultimately be resolved into mechanics. This proposition in my opinion can not be maintained. Still I believe that all motions can be mechanically explained. The mechanical theory applies strictly and without exception to any process in the objective world that is a change of place, but it does not apply to other events such as belong to another domain of generalization. There is for instance no way to explain mechanically a feeling, or an idea, or a sentiment. I can explain the physiology of sensation as a commotion in the sense organs and nerves, but not the feeling; and the simple reason is that feelings and ideas are no motions, and can not, in consequence, find a mechanical explanation.\*

Mach confesses that a perusal of Kant's *Prolegomena* made a powerful impression on him, but I do not know how it influenced him in the formation of his own thought, for nowhere in Mach's writings have I found a discussion of Kant's problem of the *a priori*. To Mach there is no *a priori*; to him the purely formal sciences are as empirical as physics and the other natural sciences. And yet he recognizes the existence of the *a priori*, in that he grants that by science we are spared direct experience. How is it possible that we can know anything if not through direct experience? Mach discovers *that* it is possible, and I have undertaken to show *why* it is possible.

\* For further elucidations see for instance *Soul of Man*, pp. 16-22.



This world of ours with which we become acquainted by experience is a peculiar mixture of two features which seem contradictory. It consists of innumerable sense-impressions picturing as many events or objects, all particular, all individual cases, each one different from the other, a wonderful chaos of single items, an unlimited pluralism. And yet this chaos is amenable to classification by similarity, sometimes even sameness of form. We meet with classifiable types many of which constitute systems of classes and subclasses, like drawers containing boxes, all arranged in logical order as genera, species and sub-species. This systematization of experience is not a human invention but is part of the world itself. It is not an artificial device of the scientist, but it is the natural growth of mind which develops as unconsciously as a tree blossoms and bears fruit. Its regularity is due to the same norm that conditions the regularity of a snow crystal or the regularity of the petals of a flower.

The immediate outcome of this classification results in the development of man's mind in the faculty of generalization, implying a wonderful economy in the household of thought and the almost magical ability of anticipating experience. This is the problem of before-hand knowledge commonly styled the *a priori*.

The problem of reason, which is identical with the problem of the nature of universals, as well as the *a priori* was well formulated for the first time, but not correctly solved, by Kant. To him reason, i. e., the whole machinery of purely formal thought, in other words, all *a priori* knowledge of any kind, is "ideal," i. e., our categories of thought and also our conceptions of time and space are mental constructions, while the data furnished by experience (our sense-impressions) are real. This is the climax of nominalism which denies the reality of universals and looks upon them as mere names (*nomina*) or, as scientists to-day

would say, "mere theories." There is nothing real in them save the breath of the voice (*flatus vocis*) that utters them.

Nominalism is the denial of an old and inveterate error of science, viz., the thingish reality of universals, which would be well characterized as a belief in philosophical mythology. We have seen what a prominent part the universal plays in the formation of man's mind, and we can not wonder that universals (especially those of practical importance) have been deified as Zeus and Athena, as Poseidon, Hades and Persephone, etc., and even the sages of antiquity who recognized at once the incongruities of mythology which treated universals as persons, nevertheless looked upon them as realities not unlike moulds which existed somewhere in the workshop of God. Such is Plato's doctrine of ideas which exist above time and space in the realm of eternity. The mediæval school that insisted on the reality of universals is called "realism" (which of course must be well distinguished from modern realism) and, establishing itself firmly in the Church as well as all great institutions of learning, it succeeded in crushing nominalism. While victorious realism became ossified in dogmatism, nominalism led a miserable existence among heretics, but proved the more vital of the two, leading up to modern science with its denial of universals in any shape.

Kant drew the last consequence by relegating all theory, anything universal and *a priori*, to the thinking subject. His idealism does not deny the reality of the objective world but claims that its order together with all laws of nature has been transferred to it by the thinking subject. Form and formal laws appertain to the latter not the former, leaving the former, the objective world, the object, the sum total of things, in itself unknown and unknowable.

Kant does not deny the objective validity of the purely formal; he only denies its reality. To him, time, space and the categories, including causality, are merely subjective,

but being inalienable features of the thinking subject, they are to every thinking subject universal and necessary, so that we can not help viewing everything through these mediums.

Mach's position is similar in many respects. He denies the reality of universals and suffers theory merely as a makeshift, as a scaffolding, temporarily erected for tentative simplification of a description of facts. Our sense-perceptions alone are real to him. Everything else, as for instance the concepts of atoms and other notions of physics, is to him a device to facilitate an analysis of sense-perceptions and to trace the interconnection of their elements.

In criticism of these views I claim that while nominalism was right in objecting to the doctrine of realism which hypostatized universals, realism was right in insisting on their reality. In other words, while our formulation of universals is subjective, there is an objective feature in the world which corresponds to them and so justifies their construction. This objective feature is form.

Form is typically objective, and it is subjective only because the thinking subject is at the same time an object moving about, like all other objects, in the objective world. The subject has constructed systems of conceptions, analogous to the forms of the surrounding world. Hence their agreement is a matter of course. There is no need of transferring them to the objective world; for they were there, before we were, and our mind together with its reason and purely formal sciences is a result of their presence in the cosmos of which we are a part.

The laws of form are universal, and mind develops (as everything else) on account of them. The cosmic order is due to the regularity of form, and the ideal construction of the laws of form in the shape of arithmetic, geometry, logic, etc., are simply a tracing of necessary results derived

from actions (such as counting and measuring) in the domain of anyness.

By anyness I understand a mental field emptied of all particularity so that its abstract emptiness is homogeneous in any of its parts and a sameness prevails throughout for any construction. In reality, i. e., in the aggregation of things, viz., the objective world, there is no such a thing as absolute homogeneousness, for every point in space and time is different from any other, and even if we assume that there was a time in which the aboriginal world-stuff was homogeneous, every particle of it was individual and different from all others, by position as well as by being itself and not its neighbor. In a certain sense you may say that anyness is an assumption of science, or if you prefer, a fiction, but there is a feature in reality that corresponds to it which we call form. It is understood that there is no form in itself, any more than there is matter in itself, or energy in itself, or anything in itself. But form as a feature of reality is as real as matter and as actual as energy. Considered by itself (which can be done by abstraction) it is empty, i. e., void of particularity, and thus it possesses that indifference which makes it applicable to any case, but the very anyness of this empty abstraction constitutes its great use in the domain of thought.

Kant's fault is that he identifies "the ideal" (i. e., the domain of thought, forms or ideas) with the subjective; hence his idealism is after all (in spite of his protests) subjectivism. Still he recognizes the validity of the laws of pure form in experience, and truth is to him not, as to the realist, an adequate representation of the thing but its consistent adaptation to the mind. Nietzsche, however, out-Kants Kant. His philosophy is nominalism with a vengeance. Truth is altogether abolished. It is denounced a fiction, nay a fraud. Logic becomes mere pedantry; consistency of thought, foolishness; and reason, a farce. Nor

does Nietzsche shrink from the last application of his denial of truth, for with its abolition he denies all difference between good and evil, right and wrong, and the higher man is not he who is nearer to truth and actualizes it in his life by doing right, but he who possesses more brute power and uses it by ruthlessly treading his fellow beings under his foot.

Is Mach's philosophy truly a mere revival of nominalism? We would be obliged to say so if it is a matter of principle with him that all theory stands condemned as mere fiction whose utility is purely temporary.

Mach points out that the method of explanation is by resolving the unknown into terms of the known, thus rendering the known familiar to us. This is true to some extent, but not altogether. The savage is familiar with the fact that fire consumes sticks of wood and sees no miracle in their disappearance. But the scientist can not be satisfied with mere familiarity. He weighs and counts and wants everything that makes its appearance or disappearance accounted for. He is not satisfied until he knows what has become of the sticks that have been burned and how the ashes originate. The scientist looks upon the world as a system in which the sum total of substance\* and energy is constant, while the form is subject to change. He deems an event unexplained until he can trace the transformation that has taken place.

Transformations are changes of place, or motions. Therefore the ideal of science will always be to reduce all physical phenomena, all the transformations that occur in space, to motions, and thus we try to render molecular

\* We say substance, not matter as is customary when speaking of the law of the conservation of matter and energy. By matter we now understand bodily reality analyzable into its chemical elements, and the term is frequently used in contrast to ether. Naturalists have of late been forced to the conclusion that matter is not eternal but that it is formed by condensation from a thinner substance which we have good reason to identify with the ether. The word "substance," being more general than "matter," would be more correct in the present connection.

changes comprehensible by thinking of them as minute motions. We do so because we can not help it, for in fact we can not even conceive of a transformation of anything except by a new adjustment of its parts which involves a change of place or motion. Mach looks upon this ideal of physical science as illegitimate and as an illusion. He believes that we happen to be best familiar with motions and therefore only mechanical explanations are most satisfactory to us. But if we assume that we were better familiar with electrical phenomena or with some others due to molecular changes, we would try to explain mechanical processes by comparing them to electrical phenomena.

There is a truth in Mach's proposition; it is this, that the unknown becomes more familiar to us by association with the known. We become accustomed to it as when a stranger is introduced to us by a friend. But to be familiar with an occurrence and to comprehend it are two different things. A full comprehension comprises not only a knowledge of all the details of a transformation, the description of a series of causes and effects, but also the reasons (commonly called laws of nature) which sum up the salient features of a whole class of phenomena in a general formula.

When Mach says there are no causes, and when Kirchhoff drops the term *Ursache* from his definition of the science of mechanics, they do so because they have in mind a wrong conception of cause. The words cause and reason have their very good use in language, but since time immemorial philosophers have confused both terms, and have mystified the world with their errors. Such phrases as "*causa sui*," "first cause" and "final cause," are evidences of the general confusion. By *causa sui* Spinoza means the most comprehensive reason which needs no explanation; he does not mean a cause at all. "First cause" is a misnomer for "ultimate *raison d'être*," and "final

cause," for "purpose." Kirchhoff was satisfied to define mechanics as a terse and exhaustive description of motions,\* and he is right; but his descriptive formulas of typical cases are exactly the reasons why a certain motion takes place in such or such a way. Galileo's law simply formulates the salient feature of the rate of acceleration in falling bodies, and Newton's law describes the function of gravitation. In other words laws of nature are (as Clifford said) uniformities.

And among the uniformities of nature, the mechanical descriptions have not accidentally become the most important ones which merely appear to be most helpful to us because we are most familiar with them. I can imagine that there are sentient beings in whom electrical or chemical senses predominate. The senses of touch, motory sense, and sight, are prominently mechanistic, being quick to observe and trace motions and mechanical changes of form. In dogs and fishes the sense of smell is marvellously well developed, and there might be animals who rely mainly on, or are adapted to perceive, thermic, electric, or other phenomena. Yet I venture to say that no chemical or electric sense could out of itself and without the assistance of either sight or motor sense have developed mind and reason. Man became man because he moved about, because he observed motions and learned to adjust his own motions. The mechanistic conception of processes renders them comprehensible. The world would remain obscure to us if we had to classify things according to odors. In fact living beings begin their career as animals of smell, but in the progress of evolution the eye and the hand develop, which organs serve best the mechanistic function of comprehension, while the olfactory lobes degenerate. I am prepared to say that reason is, if not al-

\* See the author's *Grund, Ursache und Zweck*, Dresden, 1881; *Fundamental Problems*, pp. 88-91; *Primer of Philosophy*, pp. 138-143.



together, yet most assuredly in a great and indispensable part, the product of the mechanistic interpretation of nature.

Professor Mach is quite positive in his opposition to the mechanistic conception of the world, but I have never been convinced by him.

I grant that a mechanical description of physical happenings is only a one-sided method of comprehending reality. Nay, I would go further and say that any scientific treatment is insufficient to exploit all the values of experience. Besides the intellectual interpretation of the world, we have others that can not be determined either in the balance or by the tape measure. The mystic's point of view is under certain restrictions quite legitimate, and at any rate the artist's interpretation is recognized as proper even by the larger number of scientists. However, though other viewpoints have their right, and though in their way they are apt to cover features of reality which are inaccessible to an exact valuation or computation, the methods of science will always remain indispensable and are unique in their way.

While I grant that universals are mere generalizations, and theories mere devices of science to render groups of phenomena intelligible, I yet insist at the same time that there are features in the objective world which correspond to them. Plato's conception of eternal types (the Platonic idea) is not wrong, if we make allowance for some mythological expressions. So, generally, man's conception of truth though a mental picture reflects, in so far as it is correctly worked out, an objective feature of reality. The same holds good of space and time and the purely formal sciences. Our space and time conceptions are mental constructions and some of their features are purely mental, but the relational is a factor in the objective world, and indeed it is the main factor in all processes of transforma-

tion. Any one who will take the trouble to apply my method of interpretation to the history of human thought, including the history of religion, will find much truth in error, for what at first sight seems like a string of superstitions becomes a systematic approximation in exactness of statement, and so we learn that the old chaff of tradition was not without its grain of truth.

If I appear in contrast to Mach in a reactionary light, I have held to my view not without weighing the pro and con of his standpoints, and with all due reverence to Professor Mach's prominence and fame, I must continue to hold my own, not because they are my own, but because they include all the truth propounded by Mach. I know why Mach halts, for I go beyond him and explain his views.

The points where I seem to differ from Mach (so far as I understand the situation) are exactly a recognition of the truth which will set his most helpful thoughts into a clearer light. My solution of Kant's problem will explain Mach's principle of the economy of thought and show how economy of thought originates, and why it is valid in experience, i. e., why it can be applied and relied on as a method of scientific inquiry.

Mach is a great scientist, and it is peculiar to him that unmindful of others he has pursued his own way even to isolation. As a thinker he stands by himself, and there is a gulf between him and his predecessors. Wherever his thought coincides with the thought of others, we may be sure that he arrived at the result in perfect independence, and Kleinpeter goes so far as to describe his views as contradictory to the general traditions and makes the contrast more pointed than it really is. I see in Mach a necessary and indeed healthy and extraordinarily successful phase in the development of the philosophy of science. While Kleinpeter emphasizes Mach's position in contrast to his predecessors too much, because he fails to see that there is

a truth also on the other side, I believe that a recognition of the truth as seen from the other side will lift Mach out of his isolation and will set his favorite ideas in a worthy frame.

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It seems probable to me that Professor Mach will deem my philosophy reactionary. When he sees that I recognize some truth in views which he has discarded, he will think that I have fallen behind, and march in the rear of of progress. This at any rate appears to be the impression which my writings have made on Dr. Kleinpeter. I can calmly leave the decision to posterity, and will only say here that for similar reasons I appear reactionary to many freethinkers who blame me for not joining their chorus in denouncing all religion as superstition. It is natural that he who endeavors to avoid one-sidedness will appear over-conservative to the radicals and over-radical to the conservatives.

I am the most radical among the radicals, and yet I am more truly conservative than most of the leading orthodox churchmen. I recognize no limitations, I owe no allegiance and feel under no obligations: I am willing to take the consequences of truth whithersoever it may lead. I go beyond the agnostic, who in my conception is a half-hearted thinker that does not care to be of his own opinion. He denies but does not endorse his denial and leaves it an open question, throwing the burden of responsibility upon his opponent, daring him to make the affirmation. What the agnostic deems unknowable is non-existent. There is not *such a God, no such soul, no such* immortality as he questions. But while I myself frankly deny the mythology of our traditions both in science and religion, I am not prepared to discard their meaning. I would teach mankind not to abandon their ancient conceptions of truth, but to reinterpret them, or to restate them, unencumbered with

mythology. Myths are truths poetically expressed; but negations are void of truth. The thoughtless have always found it easier to believe in the letter than in the spirit and so superstitions were unavoidable. Negations, doubt and unbelief are desirable for the sake of preparing reforms, but progress is not in them. Progress moves in affirmations, even though they are temporarily dressed up as myths and act as superstitions. The myths and parables of the past are preliminary surrogates which are insufficient approximations of the truth, and so the ideas, God, soul and immortality will remain, but the current views will have to be replaced by conceptions that are better, nobler and truer.

What is true in the history of religion is true also in the evolution of science. The old views are not quite so useless as they may appear to the iconoclast of radical reform.

EDITOR.

## THE FUNDAMENTAL CONCEPT OF THE PRIMITIVE PHILOSOPHY.

THOSE who have undertaken to set forth systematically the essential features of the religion of undeveloped man have commonly made much of the anthropomorphic character of the primitive *Weltanschauung*. Man's earliest and most natural hypothesis concerning the causes of the phenomena presented in his experience was—we are often told—that the action of external objects upon himself was referable to the same kind of causation as that which he knew to be the explanation of his own action upon external objects; namely, to conscious volition. He is therefore represented as instinctively projecting his own personality and consciousness into the things and forces around him; and primitive religion is described as involving essentially the reduplication of the directly known society of visible human persons by a less directly known society of more or less superhuman persons, present in the objects and agencies of nature; to which, of course, must be added the innumerable company of ghosts. Thus the late Dr. Brinton has declared that "the psychic origin of all religion is . . . the assumption that conscious volition is the source of all force, and that man is in communication with it."<sup>1</sup> And Guyau has insisted that "the religious sentiment has its beginning in the world at the moment in which the idea of mechanical necessity gives

<sup>1</sup> *Religions of Primitive Peoples*, p. 47.

place to the idea of a sort of moral and social reciprocity—at the moment in which there arises the conception of a possible *exchange* of feelings and even of desires, a kind of sociability, between men and the cosmic powers, whatever they may be.”<sup>2</sup> It was, of course, Mr. Tylor who first made widely familiar, and illustrated by a wide range of examples, the view that the dominant characteristic of early thought was the belief in the universal animation of nature, that “the operations of the world seemed [to primitive man] to be carried on by other spirits, just as the human body was held to live and act by virtue of its own inhabiting spirit-soul.” Since the publication of Tylor’s *Primitive Culture* (1871) the theory that the ruling hypothesis by which the savage explains his experiences is a sort of anthropomorphic animism, has been an accepted commonplace of ethnology. Even the small group of theorists who follow Mr. Spencer and Mr. Grant Allen in tracing all spirits back to ghosts, agree, at all events, in conceiving the religion of the natural races as consisting chiefly in transactions between persons—between living persons and deceased persons—under the forms natural to personal relationship, i. e., propitiation, entreaty, bargain, alliance, friendship or cajolery.

Now this anthropomorphic aspect of savage thought is, of course, undeniably a real aspect. But with the steady accumulation of fuller and more accurate ethnographic material in recent years, it has become increasingly evident that there is another still more important and pervasive—and perhaps earlier—element of the primitive philosophy. This element, however, though more or less casually recognized by several recent writers on primitive religion and folk-lore, has been far less adequately emphasized and less systematically set forth than has the theory of animism. It has hitherto, for the most part, been given

<sup>2</sup> *Irréligion de l'avenir*, p. v, vi.

neither the definiteness nor the degree of importance that it can actually be shown to possess in the savage man's scheme of the universe. That scheme, though it is, of course, full of the oddest self-contradictions, is no mere haphazard collection of unrelated superstitions; it has a curious logic of its own, which it is not impossible to unravel. The present paper is the first chapter in a study which undertakes to set forth, with rather more system and connectedness than has elsewhere been attempted, the nature, bearings, and diverse applications in custom and rite, of the central conception of early human thought, so far as that conception is brought to light in the religious and magical vocabulary and practices of savage races within historic times. This study is less an attempt to add to the sum of ethnological data, than to correlate and bring out more fully the significance of certain data that are, for the greater part, familiar to ethnologists.

For the sake of clearness, let me, at the outset, lay down somewhat dogmatically, and somewhat too categorically, what seems to be the essence of that central conception in the savage view of the world; the evidence which shall verify, and the qualifications which must hedge about, the theory, will be better understood if the broad outlines of it are first of all made plain. There is, I desire to show, a category which is yet more fundamental in the savage mind than that of personality. Behind all their anthropomorphism there is in the thinking of many or most races at this stage of culture, an idea of the nature of things and of the causation of events, which is distinctly impersonal and quasi-mechanical. With something approaching uniformity we find, as the underlying and all-controlling preconception in the thought of savages, a belief of which the following propositions express the essential features: that there is present in nature a diffused and inter-connected impersonal energy or vital force, some *quantum*



of which is possessed by all or most things or persons; that the amount of this energy is more or less fixed or limited; that any unusual, striking or alarming power, ability or productivity in anything is evidence of the special presence of this force; that it is localized in different natural objects, or possessed by different persons, in varying degrees; that the most important property of anything consists in the amount of this energy which inheres in it; that portions of such vital energy may be transferred from one person or thing to another, and may be controlled, regulated, insulated, by various devices, usually of a mechanical sort; that contact between a person or object highly charged with this energy and one less highly charged with it will, without the volition of either, produce, as it were, an explosion of vital force highly dangerous to the weaker party, and it may be to both; that the chief end of man is to get possession and control of this force; and that the chief utility of an immense variety of rites lies in the manipulation of it.

Now much of this would be recognized by many anthropologists as roughly corresponding to ideas that are verifiably present in savage thought; but a good many, I imagine, would at the same time make two objections. It would be objected, first, that savages cannot be supposed to have conceptions either so abstract or so consequential and coherent as the foregoing propositions suggest; and, second, that, in any case, these conceptions have to do, not with primitive religion, but with one phase of savage magic. I hope, however, eventually to make it evident that though savage man does not formulate his creed in any such body of propositions, his thought, as shown both in language and customs, often follows with remarkable consistency and thoroughness, the lines of the propositions that I have set down, and that with the help of the fundamental conception mentioned, a great diversity of customs not

hitherto well explained become connectedly intelligible. And against those theorists—amongst whom Mr. Frazer seems to have placed himself—who insist upon a sharp distinction between primitive magic and primitive religion, I shall maintain that the distinction cannot, upon any good ethnological grounds, be made out, in any such fashion as to exclude the conception of “diffusive and transferable life-energy” from a determinative influence upon those beliefs and observances commonly recognized as religious, as truly as upon those customarily classified as merely magical.

It can be shown that the conception in question is the most nearly ubiquitous, most all-pervasive and most influential of the notions characteristic of early man's thinking; a notion beside which all anthropomorphic ideas are of secondary, though still of great, significance. Among many undeveloped races the one great practical concern of the individual, the all-important business that chiefly engrosses his imagination, controls his activities and accounts for by far the greater part of his so-called religious customs and observances, is the endeavor to absorb into his person as much of this force, or to get into his possession as many objects charged with it, as possible, while at the same time insulating himself against it at those moments when its excessive quantity or unstable equilibrium makes it dangerous. In a word, the dominant preoccupation, probably, of most savages, is, not to “cultivate friendly relations with supernatural beings,” but to get into such *well-adjusted, quasi-mechanical relations with the source of supernatural energy*, that they may control the greatest possible amount of it for the benefit of themselves, their family, clan, village or tribe. And when, and in so far, as, savage man does undertake to deal with his environment by setting up regular personal relations with definitely anthropomorphic nature-spirits, he is still under the

influence of the same preoccupation. Those spirits are "divine," or what Mr. F. B. Jevons calls "supernatural," chiefly because the savage finds reason to credit them with the possession of a very uncommon amount of the energy upon which all power depends. What the savage chiefly wants from them is a transfusion into himself, or his clan, of some of their energy; and meanwhile, those divine spirits are often conceived as needing an occasional, or periodical, renewal of their forces, through various revitalizing processes for the performance of which the spirits continue to be wholly or partly dependent upon man.

\* \* \*

In any inquiry concerning the existence, importance and meaning of such a conception, the first question that it is natural to ask is whether peoples in the state of savagery can be shown to have in their vocabulary words expressing the general concept of such a universal, impersonal, communicable energy. It is this first stage of the inquiry only which is presented in the present paper. I have brought together from a number of sources, old and new, testimonies to the existence of such words in the language of at least three typical savage races—the North Americans, the races of Oceania, and the Bantu—and evidence that these words are the most important in the religious vocabularies of the peoples in question, being commonly, but erroneously, taken, by those who have written of those peoples to mean "god" or "spirit." The consideration of these linguistic usages not only establishes the existence in the savage mind of the rather abstract idea under consideration, but also throws a good deal of light upon the connotation and correlations of that idea and its place in primitive thought. I bring these testimonies together here, not because they are complete, but rather with the hope of eliciting more of the same kind

from collectors of anthropological material, and especially from philologists and from ethnographers in the field.

#### I. NORTH AMERICANS.

Some North American stocks have words—*manitou* among the Algonkins, *oki* among the Iroquois, *wakonda* among the Dakotas—which, as nearly as they can be reduced to any single English equivalent, appear to mean “power” or “productive energy” in the abstract, which are applied also in the concrete to any person or thing exhibiting an unusual degree of force of any sort, and which constitute the most commonly used terms in the religious vocabularies of these peoples. It was through the mis-translation of these by the English word “god,” and through the misapprehension of the peculiar abstract use of them in the singular number, that there arose the once-prevalent belief, now well known to be erroneous, that the Indians recognized a single “Great Spirit.”

1. *Dakotan Tribes.* In the case of the Dakotan word we have very clear and trustworthy information as to its use and real meaning. Thus Mr. McGee (*15th Report, U. S. Bureau of Ethnology*, p. 182) writes that among these tribes “the sun is *wakanda*—not *the wakanda*, or *a wakanda*, but simply *wakanda*; the moon is *wakanda*, and so are thunder, lightning, the stars, the winds, the cedar; even a man, especially a *shaman*, might be *wakanda*. In addition, the term was applied to mythic monsters of the earth, air and waters, to . . . fetishes and ceremonial objects, . . . many animals. . . many natural objects, and places of striking character.” “The term,” Mr. McGee goes on to suggest, “may be translated into ‘mystery’ perhaps more satisfactorily than in any other single English word, yet this rendering is at the same time too limited, as *wakanda* vaguely denotes also power, sacred, ancient, grandeur, animate, immortal.” Mr. McGee does not attempt to dis-

tinguish between the essential meaning of the word and its secondary connotations; but the rather curious list of partial synonyms which he gives, affords a fairly clear indication of the nature of the idea that lies behind. Still more clearly is the meaning brought out by Miss Fletcher in her valuable paper "On the Import of the Totem Among the Omahas."<sup>3</sup> "The foundation of the Indian's faith in the efficacy of the totem," says Miss Fletcher, "rested upon his belief concerning the nature of life. This belief was complex and involved two prominent ideas: first, that all things animate and inanimate were permeated by a common life; and second, that this life could not be broken, but was continuous. The idea of a common life was in its turn complex, but its dominating force was that which man recognizes within himself as will-power. This power which makes or brings to pass, he named *Wakonda*. The question arises, did the Omaha regard *Wakonda* as a Supreme Being? There is no evidence that he did so. . . . The word *Wakonda* seems to have expressed the Indian's idea of immanent life manifest in all things. . . . All things were distinct from man, but in the subtle bond of a common life, embodying the idea of will or directive energy, they were akin to him and could lend him the aid of their special powers, even as he could help or hinder his fellow-men. We trace the Omaha's estimate of his own will-power in the act called *Wa-zhin-dhe-dhe* (*wa-zhin*, directive energy, *dhe-dhe*, to send) in which, through the singing of certain songs, strength could be sent to the absent warrior to help him in the stress of battle, or thought and will be projected to an absent friend to help him in a game or race. . . . A similar ability to aid or injure was attributed to the elements and to all natural forces." I am disposed to think that the special identity of *wakonda* with will-power

<sup>3</sup> *Proceedings of the Amer. Assoc. for the Advancement of Science*, 1897, p. 326.

is overstated here, if by will be meant conscious and purposive volition. Miss Fletcher's own examples, as well as Mr. McGee's, seem to me clearly to show that, in the Omaha's thinking, will-power falls as a special case under the general notion of *wakonda* as productive energy—"that which makes or brings to pass"—rather than *vice versa*. There is, in Miss Fletcher's exposition, just the *soupçon* of a tendency to read the categories of modern psychology and philosophy into the Omaha's vocabulary, and to make of the Indian somewhat too much of a Schopenhauerian pantheist, conceiving of *die Welt als Wille*. But so far as the main point is concerned, the passage cited gives us unimpeachable testimony to the existence among the Dakotan tribes of a distinct and rather abstract conception of a diffused, all-pervasive, invisible, manipulable and transferable life-energy or universal force. And Miss Fletcher's paper in its entirety makes it evident that, amongst these Indians, all success, strength or prosperity is conceived to depend upon the possession of *wakonda* in sufficient quantity.

In the case of the Dakotas we have also, as it happens, evidence which enables us to connect the name, and the idea, of *wakonda* (the import of which we have just seen) directly with one of the most important and widespread of primitive beliefs—the belief, namely, in the "supernatural" or magical powers inherent in the body of woman, especially at the catamenial periods. Everywhere amongst savage peoples, as we know, "the blood is the life"; and one of the most striking evidences of the presence of a special measure of vital energy the savage imagination finds in the mysterious sanguinary discharge characteristic of the child-bearing sex—which for primitive man undoubtedly, meant originally the sex which alone had any essential part in the production of new human living beings. Now there are, as every student of savage custom knows, two

sides to the all but universal belief concerning the menstruant woman. On the one hand, she is dangerous to come near—especially for men—and radiates, as it were, an alarming sort of electricity; hence numerous taboos, and the almost world-wide custom of segregating women at such periods. But on the other hand, she is the source of a beneficent fecundating energy which can be transferred from her person to other things, especially to growing crops; hence the widespread "nudity charm," in which she marches naked by night (usually at certain phases of the moon) over the newly-planted field, for the purpose of ensuring fertility to the seed buried there. Now concerning the Omahas we are informed that they spoke of the discharges by the name *wakondithican*, meaning "pertaining to *wakonda*" (Dorsey, *Omaha Sociology*, p. 267); a woman during this period was segregated, and if any should eat with her they would become sick and their blood would turn black. Her proximity was held to be especially dangerous to young children. On the other hand, as every reader of Longfellow's *Hiawatha* knows, the use of the nudity-charm was customary among the Dakotas. It is described by Schoolcraft in his *Indian Tribes* (V, p. 70), where the connection of ideas between the *wakondithican* and the transferring of strength and fertility to the grain is sufficiently clear. Schoolcraft, it is true, represents the charm as primarily a protection against insects and blight, but it is probable that the idea was rather that of a direct projection of *wakonda* from the woman's body to the seed;—possessing that energy. the seed could resist the attacks of all its natural enemies. We have an earlier account than Schoolcraft's of a Dakotan fecundating ceremony in which the nudity-charm figures, where the conception of the transference of *wakonda* from woman to seed is unmistakably involved. A description of the corn-planting customs of the Osages is given



in a little French book published in 1827, *Histoire de la tribu des Osages*, by "M. V. P." The author of the book got his information from a party of Osages who were brought to Paris early in the last century. His report gives internal evidence of being honest and careful, and, so far as the external facts of custom are concerned, trustworthy; his translations of Dakotan terms, and his interpretations of his facts must, of course, be corrected by the later information that we have from Dorsey, McGee and Miss Fletcher. What "M. V. P." tells us is this: Women alone had charge of the corn-planting. When the time for planting came they went out naked at sun-rise [possibly this is an error, and should be "before sun-rise"] carrying a small quantity of seed-corn and invoked "*Houack-anda*" in these words: "The time has come for placing our corn in the ground; make fertile the corn that we here bring before thee!" For, as our author tells us, "les Osages croient en Dieu, qu'ils adorent sous le nom de Houackanda, que l'on peut traduire ainsi, 'Maitre-de-la-vie.'" The ceremony was repeated on five consecutive mornings; then the grains thus fecundated were mixed with the rest of the seed-corn, and after allowing five more days for the power to spread through the whole of the grain, the women planted the corn in the confident expectation of an abundant harvest. This was very likely supplemented by the further nudity charm of marching by night over the planted field.

Now we know from Mr. Mc Gee and Miss Fletcher that *wakonda* does not mean a Supreme Being nor a personal spirit; and for M. V. P.'s translation *Maitre-de-la-vie* we must substitute the impersonal "source of life-energy." But the translation of the French writer is just such as a European, imbued with theistic preconceptions, would be sure to give after hearing Indians try to explain what they meant by the term. M. V. P., again, represents

the words of the Indian women as a prayer; we must, making a similar correction, rather regard it as an incantation for putting *wakonda* into the seeds. And finally, he mentions the nudity of the women only incidentally; whereas, from all that we know about the nudity-charm, we may be quite sure that it was the essential feature of the whole ceremony. But when we make these corrections, and when we put these several items of information about the Dakotan tribes together, we get pretty clear evidence that *wakonda* was, amongst other things, conceived to be present in an especially great degree in the blood and in the person of the menstruant woman; that it had, when thus present in exceptional degree, both a dangerous and a beneficent aspect; and that in the latter aspect, it was a principle of fertility and vitality common alike to human and vegetal life, and transferable from the one to the other.

2. *Algonkins and Iroquois.* That a conception parallel to that of *wakonda* was expressed by the Algonkin word *manitou* and the Iroquois *oki* seems evident even from the superficial and unsympathetic observations of seventeenth century missionaries and explorers. Thus writes Roger Williams in his *Key to the Languages of America* (1643)<sup>4</sup>: "There is a general custom among them at the apprehension of any excellency in men, women, birds, beasts, fishes, etc, to cry out *Manitto*, that is, it is a god; as thus, if they see one man excel others in valor, strength, activity, etc., they cry out *Manitto*, a god. And therefore when they talk amongst themselves of the English ships and great buildings, and especially of books and letters, they will end thus: *Manittôwock*, they are gods; *Cummanitto*, you are a god." The Apostle to the Indians does not, to be sure, find in the linguistic usage that he thus describes quite the same significance that it has for

<sup>4</sup> *Collections of the R. I. Hist. Soc.*, I.

the purposes of the present paper, but pleasantly and piously views it as evidence that "there is a strong conviction naturall in the soul of man that God is filling all things and places, and that all excellencies dwell in God and proceed from him, and that they only are blest who have Jehovah for their portion."

It is not the first nor the last time in history that very edifying reflections have been begotten of a bad translation. *Manitou*, upon Roger Williams' showing, evidently does not mean "a god," in the personal sense, but was applied to any manifestation of extraordinary power, or to any person or thing supposed to possess such power. Champlain still earlier (1616)<sup>5</sup> bears witness to a similar usage among both Iroquois and Algonkins—though he draws from it a less edifying moral than does the benevolent Baptist. By a delightfully naive *jeu de mots* the explorer seriously seeks to make it appear that *oki* and *manitou* must mean "the Devil." It is better to give the passage in Champlain's own French:

"Ce qui fait plustost croire estre le Diable, qu'ils entendent, est que lors qu'ils voyent un homme faisant quelque chose extraordinaire, ou est plus habille que le commun, ou bien est vaillant guerrier, ou d'ailleurs en furie, comme hors de sa raison et de soy-mesme, ils l'appellent *Oqui*, comme si nous disions, un grand esprit sçavant, ou un grand Diable. Quoy que ce soit, ils ont de certaines personnes qui sont les *Oqui*, ou *Manitous*, ainsi appelez par les Algommequins, et ceste sorte de gens sont les Médecins pour guarir les Mallades, et pençer les Blessés." Compare with this a passage from Théodat's *Grand voyage au pays des Hurons*,<sup>6</sup> which I translate as literally as is necessary:

"They have some respect towards those spirits that

<sup>5</sup>*Œuvres*, IV, p. 86.

<sup>6</sup>Paris, 1632, p. 230.

they call *Oki*; but this word *Oki* signifies a great *Devil*, just as well as a great *Angel*, a furious and demoniacal spirit (or mind, *esprit*) just as well as a spirit that is good, wise or inventive, that knows or does something beyond the ordinary. Thus they often called us by this name, because we knew and taught them things which went beyond their understandings, as they said. They also called their medicine-men and magicians *Oki*, and even those amongst them who were insane, mad, or possessed." For one more early piece of evidence concerning the use of the words *oki* and *manitou*, I add a passage from Bresani's *Breve Relatione* (1653)<sup>7</sup>: "They had a superstitious regard for everything which savored a little of the uncommon. For example, if in their hunt they had a difficulty in killing a stag or a bear, and on opening it they found in its head or in its entrails a bone or a stone or a serpent, they said that such an object was an *oki*—that is, an enchantment which gave force and vigor (*forza e vigore*) to the animal so that it could not be killed; and they used it as the superstitious use reliquaries,<sup>8</sup> in order to be always prosperous."

These passages from early observers of Indian customs and linguistic usages show us, it is true, only the application of the words *oki* and *manitou* in the concrete to persons or things characterized by unusual powers; they do not show us the use of the words as names for a single, pervasive property or force of which those persons and things are supposed to be the possessors. But after these citations had been transcribed for the present paper, there has appeared an important exposition of the Algonkin idea of *manitou*<sup>9</sup> by Mr. W. Jones, based upon a special study of the Sac and Fox and Kickapoo tribes. Mr. Jones' account

<sup>7</sup> In *Jesuit Relations*, XLIX, p. 25.

<sup>8</sup> Here is the origin of the amulet and of some sorts of fetishes.

<sup>9</sup> "The Algonkin Manitou," in *Amer. Jour. of Folk-Lore*, 1905, pp. 183-191.

of the meaning of *manitou* shows that it expresses precisely the same ideas as those which, upon the evidence of specialists upon the Dakotan tribes, we have seen to be expressed by *wakonda*; and since our seventeenth century testimonies show us a complete parallelism in the employment of *manitou* and the Iroquois *oki*, it is evident that the principal term in the religious vocabulary of each of these three great North American stocks corresponds to the single conception of a diffused but unequally distributed cosmic energy. *Manitou*, Mr. Jones tells us, is primarily an impersonal substantive: "in the Algonkin dialect of the Sac, Fox and Kickapoo, a rigid distinction of gender is made between things with life and things without life; . . . when they refer to *manitou* in the sense of a virtue, a property, an abstraction, they employ the form expressive of inanimate gender," though "when the property becomes identified with objects in nature, the gender becomes obscure and confused." The Algonkin "feels that the property is everywhere, is omnipresent. The belief that it is omnipresent naturally leads to the belief that it enters into everything in nature, and the notion that it is active leads the mind to look everywhere for its manifestations." "To experience a thrill is evidence enough of the existence of the substance." "There is a lively sense of its miraculous efficiency." When the Algonkin eats the heart of an especially brave enemy, slain in battle, it is for the purpose of absorbing *manitou* into himself. Particularly instructive is the explanation of the meaning of the sweat-lodge observances, given Mr. Jones by an Indian of the Fox tribe: "Often one will cut oneself over the arms and legs, . . . it is done to open up many passages for the *manitou* to pass into the body. The *manitou* comes from its place of abode in the stone. It becomes aroused by the heat of the fire, . . . proceeds out of the stone when the water is sprinkled upon it, . . . and in the steam it enters the body, . . . and imparts

some of its nature to the body. That is why one feels so well after having been in the sweat-lodge."

The great majority of the religious or magical ceremonies and observances customary amongst these Indian peoples are clearly more or less directly connected, in their minds, with the idea of *manitou*, *oki*, or *wakonda*. Totemism (as Miss Fletcher has shown), the fetish or "personal medicine," the ceremonies connected with agriculture, the taboos relating to women, the sweat-lodge ceremonies, the beliefs relating to blood and the heart: all these can be shown, not by the inferences of folk-lorists but from the language of the Indians themselves, to get their meaning from the one underlying conception concerning the nature, distribution, and special vehicles, of that impersonal vital energy by the possession of which all power and efficacy is acquired. And the list apparently does not end here. "The rules of the buffalo hunt," says Dorsey,<sup>10</sup> "the consecration of the hearts and tongues, the ceremonies pertaining to the anointing of the sacred pole, and those connected with planting of the corn, were customs which were regarded as laws received by their ancestors from Wakanda." Dorsey here gives what we know to be an erroneous personification to *wakonda*; but what his Indian informants were trying to tell him, we may reasonably suppose, was that all these ancestral customs had always been regarded as having something to do with the *wakonda* idea.

## II. MELANESIANS AND POLYNESIANS.

That the same conception is current amongst the more or less mixed races of Oceania we know from the best authorities upon the ethnology of the island peoples. "The Melanesian mind," says Codrington,<sup>11</sup> "is entirely pos-

<sup>10</sup> *Omaha Sociology*, p. 368.

<sup>11</sup> *The Melanesians*, 1891, p. 118.

essed by the belief in a supernatural power or influence, called almost universally *mana*. This is what works to effect everything which is beyond the ordinary power of men, outside the common processes of nature, attaches itself to persons and to things, and is manifested by results which can only be ascribed to its operation." And again:<sup>12</sup> "It is a power or influence not physical and in a way supernatural; but it shows itself in physical force or in any kind of power or excellence which a man possesses. This *mana* is not fixed in anything, and can be conveyed in almost everything; but spirits, whether disembodied souls or supernatural beings, have it and can impart it; and it essentially belongs to personal beings to originate it, though it may act through the medium of water or a stone or a bone. *All Melanesian religions consist in obtaining 'mana' or deriving benefit from it.*" The Polynesian *atua*, says Ratzel, has a similar meaning; and the idea "recurs in *Ani* or *Han* of Ponape, the *Kasinge* or *Kalit* of Pelew, the *Anut* of Kusaie, and the *Yaris* of Tobi," Among the Maori, we are told,<sup>13</sup> "the generic name of *atua* which applied to every kind of supernatural beings and mysterious objects did not convey a distinct idea of god or a divinity, but it was simply an invisible, shadow-like existence, an impalpable breath, whose nature was mysterious, without definite attributes or well-defined powers of action. . . . Their *atua* was a mysterious something which they could not explain, a name given to all active agencies of nature whose mode of action was incomprehensible, but which were nevertheless supposed to produce real and palpable results in the social and physical economy of the world. The strangers that first came among them sending thunder and lightning by the discharge of the fire-arms were real *atuas*. A watch, whose

<sup>12</sup> P. 119, note.

<sup>13</sup> Featherman, *Social History of the Races of Mankind*, II, p. 207.



wonderful movements they did not understand, was an *atua*," etc.

In the case of the Malagasy, a race akin to the Polynesians, the same conception is expressed by the word *andriamanitra*. "Whatever is great, whatever exceeds the capacity of their understandings, they designate by the convenient and comprehensive designation *andriamanitra*. Whatever is new and useful and extraordinary is called god."<sup>14</sup>

### III. THE BANTU.

Much as has been written about the Bantu peoples, there has, I believe, until very lately been no good evidence of the prevalence amongst them of a similar idea—so readily does the nature of such an idea escape the apprehension of ethnographers and missionaries. Quite recently, however, Mr. A. Hetherwick, for many years a missionary at Blantyre, has informed us—apparently without knowing of the existence of a similar usage amongst other races—that the commonest and most familiar term in the religious vocabulary of some (at least) of the Bantu tribes is used in a sense precisely analogous to that which we have seen to belong to *wakonda*, *oki*, *manitou*, and *mana*.<sup>15</sup> "The word *mulungu*," he writes, "is used by the Yao in a wide application. Etymologically the word is connected with the root *kulungwa*, which in so many other branches of the Bantu tongue appears as *kulu* or *kuru* and signifies 'great' or 'old.' It is the same word which appears in the Kaffir word for God, *Unkulunkulu*, which may be rendered as 'the old, old one' or 'the great, great one.' In its native use and form the word does not imply personality, for it does not belong to the personal class of nouns. Its form rather denotes a property inhering in

<sup>14</sup> Ellis, *Hist. of Madagascar*, cited by Marett in *Folk-Lore*, 1900, p. 169.

<sup>15</sup> In *Journal of the Anthropol. Inst. of Great Britain*, Vol. 33, p. 93.

something, as life or health inheres in the body. Among the various tribes where the word is used, missionaries have adopted it as the word for God. But the untaught Yao refuses to assign to it any idea of being or personality. It is to him more a quality or a faculty of human nature, whose significance he has extended so as to embrace the whole spirit world. [Yet] the Yao speaks of what *mulungu* has done or is doing. It is *mulungu* who [sic] made the world, man and animals. . . . *Mulungu* is regarded also as the agent in anything mysterious. 'It is *Mulungu*!' is the Yao's exclamation on being shown anything that passes the range of his understanding."

There is reason to suppose that among the mixed Hamitic-Negro stock, the Masai, a similar meaning and the same peculiar width of application belongs to the term *ngai* or *en-gai*. "Their conception of deity," says Thomson, in his *Through Masailand*,<sup>16</sup> "seems marvelously vague. I was *ngai*. My lamp was *ngai*. . . . In fact, whatever struck them as strange and incomprehensible, that they at once assumed has some connection with *ngai*." A more recent writer upon the Masai,<sup>17</sup> it is true, declares that "the prayers for children, rain and victory are addressed to *En-gai* as a distinct personality 'who is prayed to and hears.' " But the same writer adds that, "on the other hand, the sun and moon, the morning and evening star and the mountain clouds are also invoked" (apparently under the same name), and that "in one song a certain medicine-man appears to be expressly referred to as *En-gai*." Mr. Hollis suggests, therefore, that we may "have here primitive and undeveloped religious sentiment where the personality of the deity is hardly separated from striking natural phenomena."

<sup>16</sup> 1885, p. 445.

<sup>17</sup> Hollis, *The Masai*, 1905, p. xix.

I have cited these testimonies with perhaps excessive fullness and in the words of the original describers of the usages in question, for the reason that the (in some cases) almost verbal identity of the accounts given by so many independent observers of three wholly distinct races, seems to me in itself a significant circumstance. By several of these observers the finer ramifications and the less obvious meanings of the idea were missed; but nearly all—whether they are describing North American, Melanesian, Polynesian or African—insist upon certain identical points, namely: that the most important and most frequently employed religio-magical term in the languages of these peoples is the name of something rather impersonal than personal; that the conception of this something wavers between that of a communicable property, that of a mobile, invisible substance and that of a latent transferable energy; that this substance, property or energy is conceived as being widely diffused amongst natural objects and human beings; that the presence of it is promptly assigned as the explanation of any unusual or exceptional power or efficacy which any object or person is found to possess; that the mind of the savage of these races is intensely interested in this force or property and greatly preoccupied with the thought of it. And in the case of the American Indians the evidence shows us still more. With them the conception is distinctly that of a pervasive energy, which tends to become especially localized in particular objects; and their languages as well as their customs show that this idea is directly involved in their beliefs concerning the special dangers and also the special magical efficacy connected with blood and with the sexual peculiarity in women. Furthermore, we have seen that, among the Indians, the same productive power that is, naturally enough, conceived to manifest itself in the vital fluid and the body of the child-bearing sex, is likewise conceived to be the source

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of all fertility in nature; and that the purpose of their agricultural fertility-charms and sacrifices is expressly that of transferring this indispensable energy from beings or objects that possess it in superabundance to the growing crop. And since the Indian way—the peculiar and striking way—of using the word *manitou* or *wakonda*, as reported by more superficial observers, is precisely the same as the usage of *mana*, *atua*, *ngai*, and the rest, as reported by other superficial observers, it seems, to say the least, not improbable that the meaning and the associations of ideas which a more accurate observation shows to belong to *manitou* and *wakonda* also belong to the corresponding Melanesian, Polynesian, and Bantu words.

When, therefore, I attempt—as I shall subsequently do—to connect in detail a great variety of savage customs and beliefs with this conception, I shall at least be dealing with a *vera causa*—with an idea that is not merely inferred from the customs which it is used to explain, but can be shown to exist by independent evidence. The facts of linguistic usage here adduced already indicate the prime importance of this conception in the savage philosophy, and give us the clue to its ramifications and specialized applications in the scheme of primitive belief. On the other hand, it is not until those customs are examined and correlated, that one can understand adequately the scope and the influence of the conception, and the way in which the mind of undeveloped man works in the use of it. In a word, evidence from language and evidence from the analysis and comparison of customs and ceremonies will be found reciprocally to corroborate and illuminate one another; and taken together, I think, they suffice to make it clear that the idea of *manitou* or *mana* lies at the bottom—though in different manners and for different reasons—of many sorts of taboos; of the beliefs and observances relating to woman and her supernatural powers; of several

kinds of sacrifice; of a number of periodic ceremonies and feasts connected with agriculture among most agricultural races, and, indeed, of the greater part of all primitive agricultural rites; of moon and sun cults, or at least of certain features commonly characteristic of those cults; of the observances relating to the "sacred fire"; of some frequent features of the initiation rite; and of certain elements of the primitive eschatology. There is no "key to all the mythologies"; that is to say, the several aspects of the thought of savage man—its animism, its ghost-beliefs, etc.,—are not reducible to one another, nor necessarily traceable to a common origin. But there is one idea which is of paramount importance in the early evolution of religious and scientific thought and practice, for the reason that it generates a large part of primitive belief and custom, and widely and subtly interpenetrates the beliefs and customs which have an independent origin.

The place of this conception in the thought of savage races has, for the most part, gone unrecognized by folklorists and writers on primitive religion. It is hardly too much to say that most of the systematic treatises on these subjects essentially misrepresent primitive belief, and explain wrongly most of the customs of which they treat, through their neglect of the *manitou*-idea. Even so recent and so admirably learned a work as Mr. Frazer's *The Golden Bough* takes no sufficient account of that idea, while it very much overworks the notion of sympathetic magic. To Mr. Frazer the term *wakonda* is simply synonymous with *tabu*; of its real meaning, and of its real synonyms in the other Indian languages and those of the Polynesians, Melanesians and Bantu, he apparently knows nothing.\* Similarly Mr. Ernest Crawley's recent study of primitive marriage, *The Mystic Rose*, 1902, which deals chiefly with sexual taboos, misses (I cannot but think) the true expla-

\* *Golden Bough*, 2d. ed., I, p. 343.

nation of most of those taboos altogether, through a failure to connect them with the same idea. But it ought to be observed that several writers have already noticed this feature of savage thought, and that the disposition to recognize its nature and importance is steadily growing. Dr. Brinton, for example, knew the Indian languages and customs far too well to miss this point altogether. "*Wakonda*," he wrote in his last work,<sup>18</sup> "was not a deity, but expressed the deific power believed to be present in men, animals and things." And more generally, he notices the occurrence in early thought of the idea that "all gods and holy objects were merely vehicles through which life and power poured into the world from the inexhaustible and impersonal source of both."<sup>19</sup> Yet in the same volume we find the inconsistent declaration already noted, that the "psychic origin of all religious thought" is the "belief that behind the phenomenal world lies the ultimate power of mind, of conscious will, of intelligence analogous in some way to our own." "To the undeveloped reason the Other is ever conceived as Another, a Self, and is clothed with the attributes of the thinking Ego." Dr. Brinton thus failed to make serious use of the truth of which he had caught a glimpse—which is the more unfortunate because his book is in many respects well fitted to be what it has actually become, the best-known popular manual of the subject.

A little later Mr. R. R. Marett called attention to the peculiar use of the terms *mana*, *wakonda*, *ngai*, *andriamanitra*, and made that usage the basis of his theory of a "pre-animistic religion."<sup>20</sup> Mr. Marett does not, however, seem to me to do full justice to all sides of the belief which was "logically and chronologically prior to Anim-

<sup>18</sup> *Religions of Primitive Peoples*, 1897, p. 60.

<sup>19</sup> *Ibid.*, p. 164.

<sup>20</sup> In *Folk-Lore*, 1900, p. 180.

ism, constituting as the latter does but a particular embodiment of the former." For he finds the essence of that belief to lie in the apprehension "of the supernatural or supernormal, as distinguished from the natural and normal." It arose when "the emotions of awe, wonder, and the like...outstripped the power of 'natural,' that is, of reasonable explanation." "Of all English words Awe is, I think, the one that expresses the fundamental religious feeling most nearly...*Primus in orbe timor fecit deos* is true only if we admit wonder, admiration, interest, respect, even love perhaps, to be, no less than fear, essential constituents of these elemental moods." Mr. Marett accordingly proposes to name this primordial religious attitude "Supernaturalism," or preferably, "Teratism." Now such a theory is naturally enough suggested by the peculiarity of the use of the terms in question which most commonly strikes the missionary and the traveler; namely, the savage's fashion of promptly applying those terms to anything novel, surprising, incomprehensible or alarming. But I think a careful consideration of the passages cited earlier in this paper will make it evident that *wakonda* or *manitou* or *mana* are not primarily names for the "supernormal" or the astonishing—and certainly not for that which evokes awe, respect and love—but rather for the efficacious, the powerful, the productive. What the "elemental mood" was we really do not know; what we do know is that the *wakonda* or *mana* that the actual savage is so supremely concerned about is essentially a sort of diffused substance or energy upon the possession of which all exceptional power or ability or fecundity depends. This energy is, to be sure, terrible (under certain circumstances) and it is mysterious and incomprehensible; but it is so because it is vastly powerful, not because the things that manifest it are unusual or "supernatural" or such as "defeat reasonable expectation." In other words, Mr. Ma-



rett appears to me to put the emphasis on the wrong side, and consequently to underestimate the importance of this idea in engendering all sorts of magical observances of a fecundative or prophylactic sort. The pre-animistic belief—the belief which is, at all events, independent of animism—is not best described as “supernaturalism” or “teratism,” for the fundamental notion in it is not that of the unpredictable, abnormal and portentous, but that of a force which is conceived as working according to quite regular and intelligible laws—a force which can be studied and controlled. A better name, then, for this group of beliefs would be “Primitive Energetics.” In spite of these criticisms, however, Mr. Marett’s paper is notable as being probably the earliest to insist clearly and unequivocally upon the primacy in early thought of a non-animistic conception expressed by such terms as *wakonda* and its synonyms.

Still more recently MM. Hubert and Mauss, writing in *L’année sociologique* for 1902-3, seem to have substantially anticipated the main conclusions of the present paper. Their *Mémoire*<sup>21</sup> I have been unable to see; but upon essentials it apparently agrees pretty closely with the theory here presented. Finally Prof. D. N. Söderblom, in his little manual *Die Religionen der Erde*<sup>22</sup> has set forth briefly and inadequately, but quite clearly, some aspects of what he calls the conception of *Lebenselektrizität* in savage belief.

In concluding, it is worth while to urge upon ethnologists and students of early religion the adoption of a rec-

<sup>21</sup> It is known to me only from Mr. Hartland’s notice in *Folk-Lore*, 1903; and has come to my attention after the greater part of this paper was completed. It is perhaps proper to mention that the conclusions here set forth were reached in 1900, independently of any of the writers mentioned, though they were much influenced by the writer’s studies under the late Léon Marillier—whose unrivalled stores of accurate learning concerning savage thought and custom were lost to science through his untimely death, before he had published any work commensurate with his knowledge and his powers.

<sup>22</sup> 1905, p. 8-9.

ognized and unambiguous name for the sort of primitive conception that has here been set forth and that promises soon to receive the general attention that it deserves. I have already intimated that, if one must have a word of Greek or Latin origin, "Primitive Energetics" appears to be a better name than either of those suggested by Mr. Marett. But the use, in naming features of savage belief, of stems already found in other English words, and having already established connotations, has proven to be a disadvantageous practice. Terms so constructed are almost certain to be both equivocal and misleading. Tylor's invention of the term "animism," for example, has introduced a singular amount of confusion into ethnology. A good deal of Mr. Spencer's labored and unprofitable reasoning concerning the origin of religion is, for example, almost wholly due to the more or less misleading connection between the words "animism" and "animate." It is better, where possible, to adopt as the designation of a widespread primitive concept or custom one of the native names for it. Of the concept here under discussion the North American Indian names are perhaps the most familiar, and their full scope and meaning has been most clearly and authoritatively set forth. *Wakonda* and *oki*, however, are vocables that cannot very expressively or euphoniously be anglicized. The Algokin *manitou* is less open to this objection; and it is, in any case, the most generally familiar of all the Indian terms of this class. I venture, therefore, to propose that those who treat of such matters should agree—until a better name be found—to refer to the primitive belief in a pervasive, life-giving, impersonal energy as *manitouism*, and to that energy itself as *manitou*.

ARTHUR O. LOVEJOY.

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## THE BIBLE, THE PERSIAN INSCRIPTIONS, AND THE AVESTA.

**H**OW our distinguished popular expounders of the Bible can proceed in their all-important tasks without some attempt to acquire such interior information as may be available about the religion of Cyrus and Darius is difficult for an expert to understand.

These imperial persons, according to our own venerated Semitic Scriptures, actually restored the Jewish tribes to Jerusalem, permitting, encouraging and assisting the rebuilding of the city and even of the Temple.

As we read throughout Ezra and the rest, it is obvious that they did everything which it was conceivable for them to do to meet the national religious aspirations of the exiled tribes; and that they did so, moved by some correspondence between their own religious opinions and those of their protégés was at least believed by the Jewish writers to be the fact; see the extensive statements everywhere.

And we may indeed certainly concede that the Persian rulers were animated by some measure of sentiment aside from political expediency. According to the Jews Cyrus was actually inspired by "the God of Heaven" to take the course which he did take toward the Israelites—and in Isaiah xliv and xlv he is accepted by Yahveh Elohim as 'His Anointed'; and we may safely infer that the same approbation was supposed by Ezra and his colleagues to have been present in the mind of the Jewish Deity toward Darius

and his successors. If we had no records whatever of these distinguished Iranian monarchs, our inattention might be condoned, for we could then only dimly conjecture what their religion might have been; but we possess documents of it which surpass in certified authority almost all other equally ancient records of the human race. For their main bulk consists of the well-preserved Persian Inscriptions of Behistan, Persepolis, Naksh i Rستم, etc. These impressive sculptures have long since been deciphered, and except for an isolated difficulty here and there they are easier than the Bible, that is to say, than parts of it; they are certainly easier than the Avesta. They are of course meagre as to extent when regarded as literature; but they are perhaps the fullest of all closely related inscriptions upon stone, while their religious fervor, whether genuine or affected, is the strongest ever recorded in such writings and hardly surpassed by any compositions anywhere. Nowhere in literature within the same compass of words are such trenchant and dogmatic assertions made of the existence of One Supreme God as the Creator of "this Earth and yon Heaven, of man, and of amenity for him"—and not even in the Psalms have we more strenuous iterations of personal faith. "Then I prayed to Auramazda," Darius wrote for his stone-cutters, "Auramazda brought me aid—by the gracious will of Auramazda I became King;" and from that on everything favorable which he did or which happened to him occurred, as he asserts, "through the gracious will of Auramazda." The name, as we know, was one of the purest and most significant perhaps ever applied to a believed-in deity, probably far superior to our own word "God" in both its origin and bearing.\* It means "the life-spirit-Lord, the Great Creator"; or the latter word may mean "the Wise One"; so my

\* In the light of refined reason, and in view of all Indian usage, compare Asura which is Ahura;—what name approached it?

colleagues generally prefer, following tradition. He restored the temples which Bardiya (Smerdes) destroyed in his Magian iconoclasm just as he and Cyrus restored the temple at Jerusalem, and as Cyrus restored the Temple City Eshshakil (so) at Babylon, and there is hardly a place where the words "by the gracious will of Auramazda" could come in where they are not cut. The iteration is unexampled. He must have been the champion hypocrite of all the ages if he did not believe that God was indeed his supporter.

But these quite astonishing accumulations of fervent personal religious feeling have a certain peculiarity which at once deepens as it intensifies our problem.

It is this: the same expressions recur without variation, letter for letter, throughout the reigns of Darius, Xerxes, Artaxerxes the II and the III, something over a hundred years. We have indeed the side sentence showing deeply-rooted and superficially animated sentiment,—but even these are repeated like formulas while the main phrases were positively such; they must have headed many a political document as well as these formal summaries of sculptured history.

The chief terms were of course household words as well as familiar in every possible school of religious learning, or center of public service, which is of course a matter of deepest import to the history of religion;—for it proves something so hard to believe that we are almost tempted to exclamatory adjectives. It seems actually to establish the certain fact that in a most effective percentage these formulas expressed the sincere religious convictions of a portion of the populations, and if only of a portion, yet how vast must have been the aggregate.

If Darius ruled from Egypt to India and from the Ocean to the Caspian, surely five per cent. alone must have meant a million souls, and that in generation after gen-

eration. Is it possible that these people could have been intellectually convinced, as no such populations upon the face of the earth were then convinced, of the omnipotence of a supreme good God, whose primal attribute was truth, and yet not have experienced some genuine religious emotions which ultimately formed themselves into religious principles and religious character, especially among that portion of the people who were still young? Surely every pastoral clergyman knows that this is impossible. People by the millions must have been genuinely pious in Persia under the Achæmenids.

We are still, let us hope, acutely sensible of the importance of religious revivals, although they may have taken place in times long past and resulted from the early propagation of the Gospel,—and these latter claim of course a sacred precedence among all revolutions of religious sentiment,—but no true Christian can ignore the possible regenerations of moral character which must have taken place under this sublime and simple creed of Darius and of the Gathas. Of course other gods are recognized such as Mithra and Anahita, and so in the later Avesta. We Christians have also our Archangels, and it can hardly be said that we refrain from worshiping our saints; that is to say, not those of us who have the pre-eminent right to represent the Faith. In the wonderful Gathas, however, which are closely related to the inscriptions, there is no Mithra mentioned, nor is there any Anahita, and the Archangels themselves are primarily the attributes of God. It was by far the most intellectual and refined system that had ever been developed anywhere at their period or, as some might say, since then.

We must not indeed conceal the defect that even Darius in the very acme of his almost passionate expressions (of trust in God) takes pains to record and with obvious satisfaction his execution of his captured arch-enemies, and he

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does not shrink from giving us the details of his barbarity; but we must also not forget that if Darius had not struck terror upon his other opponents by such ghastly exhibitions, those other opponents would undoubtedly have experienced no hesitation;—they would have struck terror upon his survivors by executing him with every exactly similar fiendish horror;—moreover these infamies have been at least equalled, if not indeed excelled in the executions of Christian believers by Christian believers themselves.

And we can not say that the masses of the populations were responsible for these enormities (though they evidently thought them to have been deserved), so that we cannot at all on this account exclude the conviction that a really vast amount of genuine personal piety, equal in its type to that of our own middle ages, must have prevailed in the Persian Empire at this period.\* Can Christian pastors and teachers afford to ignore this mighty spiritual fact, or great series of facts in teaching the Bible to their hearers, especially when it is indubitably true that the whole course of our religious history might have been, nay must have been, different but for the interposition of those friendly rulers? Christ doubtless would have been born in the fulness of time, and would have taught and agonized, but who can say that these events would have taken place in Palestine, and have possessed at all the influence which they have now in fact exerted? Surely we can spare a few cheap hours for finding out what lies beneath it all.

LAWRENCE H. MILLS.

OXFORD, February, 1906

\* See my detailed remarks in *Zarathushtra, the Achaemenids and Israel*.



## MAGIC CUBES.

THE curious and interesting characteristics of magic squares may be applied to figures of three dimensions constituting magic cubes.

Cubes of odd numbers may be constructed by direct and continuous process, and cubes of even numbers may be built up by the aid of geometrical diagrams. In each case the constructive methods resemble those which were explained in a previous article in connection with odd and even magic squares.

### CHARACTERISTICS OF MAGIC CUBES.

The characteristics of magic cubes, odd or even, are that all straight columns, whether running from the top of the cube to the bottom, from the front to the back, or from one side to the other, should sum up to the same amount, also that the four diagonal columns which unite the eight corners of the cube and the two corner diagonal columns of every square in the cube should sum up to the same amount as the straight columns. Furthermore, the sum of any two numbers that are located in cells diametrically opposite to each other and equidistant from the center of the cube should equal the sum of the first and last numbers of the series used, and in all odd magic cubes, the center cell must contain the middle number of the series. Magic cubes which do not exhibit these characteristics may be considered imperfect.

Using  $N$  to express the number of cells in one column of a cube, which begins with unity and proceeds with increments of 1, the sum of the numbers in each column is expressed by the formula:

$$\frac{N}{2} (1 + N^2)$$

If the initial and increment numbers are more or less than unity, the following general formula may be used to express the column value.

Let:

$A$  = initial number,

$B$  = increment number,

$N$  = number of cells in each column,

$S$  = summation number,

then:

$$\frac{N}{2} [B(N^2 - 1) + 2A] = S.$$

#### ODD MAGIC CUBES.

The smallest magic cube is naturally  $3 \times 3 \times 3$ . The twenty-seven numbers in this cube are capable of many different magic arrangements, none of which, however, possess perfect characteristics.

10	24	8	9	26	6	8	15	19
23	7	12	2	1	3	12	25	5
9	11	22	8	15	19	22	2	18

FIG. I.

Fig. 1 shows one of these cubes, and in columns I, II and III, Fig. 2, there are given the nine different squares which it contains. In this cube there are twenty-seven straight columns, two diagonal columns in each of the

three middle squares, and four diagonal columns connecting the eight corners of the cube, making in all thirty-seven columns each of which sums up to 42. The center number is also 14 or  $\frac{1 + N^3}{2}$  and the sum of any pair of geometrically opposite numbers is 28 or  $1 + N^3$ . In these points this cube approaches perfection, but it fails in the fact that the totals of the corner diagonals of the six outside squares consist of various numbers other than 42.

THREE SQUARES  
FROM TOP TO BOTTOM  
COLUMN I.

10	26	6
24	1	17
8	15	19

23	3	16
7	14	21
12	25	5

9	13	20
11	27	4
22	2	18

THREE SQUARE  
FROM FRONT TO BACK  
COLUMN II.

8	15	19
12	25	5
22	2	18

24	1	17
7	14	21
11	27	4

10	26	6
23	3	16
9	13	20

THREE SQUARES  
FROM LEFT TO RIGHT  
COLUMN III.

10	24	8
23	7	12
9	11	22

26	1	15
3	14	25
13	27	2

6	17	19
16	21	5
20	4	18

FIG. 2.

All totals = 42.

In describing the direct method of building odd magic squares in a previous article, many forms of regular advance moves were explained, including right and left diagonal sequence, and various so-called "knights' moves." It was also shown that the order of regular advance was periodically broken by other well defined spacings which were termed "breakmoves." In building odd magic squares, only one form of breakmove was employed in each

square, but in the construction of odd magic cubes, two kinds are required in each cube which for distinction may be termed  $N$  and  $N^2$  breakmoves respectively. In magic cubes which commence with unity and proceed with increments of 1, the  $N^2$  breakmoves occur between each multiple of  $N^2$  and the next following number, which in a  $3 \times 3 \times 3$  cube brings them between 9 and 10, 18 and 19, and also between the first and last numbers of the series, 27 and 1. The  $N$  breakmoves are made between all other multiples of  $N$ , which in the above case brings them between 3 and 4, 6 and 7, 12 and 13, 15 and 16, 21 and 22, and 24 and 25. With this explanation the rules for building the magic cube shown in Fig. 1 may now be formulated, and for convenience of observation and construction, the cube is divided horizontally into three sections or layers, each section being shown separately in Column I, Fig. 2.

It may be mentioned that when a move is to be continued *upward* from the top square it is carried around to the bottom square, and when a move is to be made *downward* from the bottom square, it is carried around to the top square, the conception being similar to that of the horizontal cylinder used in connection with odd magic squares.

Commencing with 1 in the center cell of the top square, the cells in the three squares are filled with consecutive numbers up to 27 in accordance with the following directions:

- Advance move. One cell down in next square up (from last entry).
- $N$  breakmove. One cell in downward right hand diagonal in next square down (from last entry).
- $N^2$  breakmove. Same cell in next square down (from last entry).

If it is desired to build this cube from the three vertical squares from front to back of Fig. 1, as shown in Column II, Fig. 2, the directions will then be as follows: commencing with 1 in the middle cell of the upper row of numbers in the middle square,

Advance move. One cell up in next square up.

N breakmove. One cell in downward right-hand diagonal in next square up.

N<sup>2</sup> breakmove. Same cell in next square down (from last entry).

TABLE I.

	A	B	C		A	B	C		A	B	C
1	/	/	/	10	2	/	/	19	3	/	/
2	/	/	2	11	2	/	2	20	3	/	2
3	/	/	3	12	2	/	3	21	3	/	3
4	/	2	/	13	2	2	/	22	3	2	/
5	/	2	2	14	2	2	2	23	3	2	2
6	/	2	3	15	2	2	3	24	3	2	3
7	/	3	/	16	2	3	/	25	3	3	/
8	/	3	2	17	2	3	2	26	3	3	2
9	/	3	3	18	2	3	3	27	3	3	3

FIG. 3.

Finally, the same cube may be constructed from the three vertical squares running from left to right side of Fig. 1, as shown in Column III, Fig. 2 commencing, as in the last example, with 1 in the middle cell of the upper row of numbers in the middle square, and proceeding as follows:

Advance move. Three consecutive cells in upward right-hand diagonal in same square (as last entry).

N breakmove. One cell in downward right-hand diagonal in next square down.

$N^2$  breakmove. One cell down in same square (as last entry).

Five variations may be derived from this cube in the simple way illustrated in Table I on the preceding page.

Assign three-figure values to the numbers 1 to 27 inclusive in terms of 1, 2, 3 as given in Table I, Fig. 3, and change the numbers in the three squares in Column I, Fig. 2, to their corresponding three-figure values, thus producing the square shown in Fig. 4. It is evident that if the arrangement of numbers in the three squares in Column I were unknown, they could be readily produced from Fig. 4 by the translation of the three-figure values into regular numbers in accordance with Table I, but more than this can be accomplished. The letters A, B, C in Table I in-

	A	B	C	A	B	C	A	B	C	
<i>Top Square</i>	2	/	/	3	3	2	/	2	3	1 <sup>st</sup> Line
	3	2	3	/	/	/	2	3	2	2 <sup>nd</sup> .
	/	3	2	2	2	3	3	/	/	3 <sup>rd</sup> .
<i>Middle Square</i>	3	2	2	/	/	3	2	3	/	1 <sup>st</sup> Line
	/	3	/	2	2	2	3	/	3	2 <sup>nd</sup> .
	2	/	3	3	3	/	/	2	2	3 <sup>rd</sup> .
<i>Bottom Square</i>	/	3	3	2	2	/	3	/	2	1 <sup>st</sup> Line
	2	/	2	3	3	3	/	2	/	2 <sup>nd</sup> .
	3	2	/	/	/	2	2	3	3	3 <sup>rd</sup> .

FIG. 4.

dicate the normal order of the numerals 1, 2, 3, but by changing this order other triplets of  $3 \times 3$  squares can be made which will differ more or less from the original models in the arrangement of their cell numbers, but which will retain their general magic characteristics. The

changes which may be rung on A, B, C, are naturally six, as follows:

A. B. C.

C. B. A.

B. C. A.

B. A. C.

C. A. B.

A. C. B.

<table><tr><td>2</td><td>18</td><td>22</td></tr><tr><td>24</td><td>1</td><td>17</td></tr><tr><td>16</td><td>23</td><td>3</td></tr></table>	2	18	22	24	1	17	16	23	3	<table><tr><td>4</td><td>18</td><td>20</td></tr><tr><td>26</td><td>1</td><td>15</td></tr><tr><td>12</td><td>23</td><td>7</td></tr></table>	4	18	20	26	1	15	12	23	7	<table><tr><td>2</td><td>24</td><td>16</td></tr><tr><td>18</td><td>1</td><td>23</td></tr><tr><td>22</td><td>17</td><td>3</td></tr></table>	2	24	16	18	1	23	22	17	3	<table><tr><td>4</td><td>26</td><td>12</td></tr><tr><td>18</td><td>1</td><td>23</td></tr><tr><td>20</td><td>15</td><td>7</td></tr></table>	4	26	12	18	1	23	20	15	7	<table><tr><td>10</td><td>24</td><td>8</td></tr><tr><td>26</td><td>1</td><td>15</td></tr><tr><td>6</td><td>17</td><td>19</td></tr></table>	10	24	8	26	1	15	6	17	19
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FIG. 5. (B. C. A.) FIG. 6. (C. A. B.) FIG. 7. (C. B. A.) FIG. 8. (B. A. C.) FIG. 9. (A. C. B.)

The combination of 1, 2, 3 being given in normal order in the original cube, the five cubes formed from the other combinations are shown in Figs. 5, 6, 7, 8, and 9.

These magic cubes may also be constructed by the direct method in accordance with the simple directions set forth in the adjoined diagram.

Fig 10 is an example of another  $3 \times 3 \times 3$  cube in

TOP SQUARE.

1	17	24
15	19	8
26	6	10

MIDDLE SQUARE.

23	3	16
7	14	21
12	25	5

BOTTOM SQUARE.

18	22	2
20	9	13
4	11	27

FIG. 10.



which the first number occupies a corner cell, and the last number fills the diametrically opposite corner cell, the middle number coming in the center cell in accordance

DIRECTIONS FOR CONSTRUCTING THE  $3 \times 3 \times 3$  MAGIC CUBE SHOWN IN FIG. I, AND FIVE VARIATIONS OF THE SAME.

COMBINATION	ADVANCE MOVES	N BREAKMOVES	N <sup>2</sup> BREAKMOVES
A. B. C.	One cell down in next square up	One cell in right-hand downward diagonal in next square down	Same cell in next square down
B. C. A.	Three consecutive cells in upward left-hand diagonal in same square	One cell to left in next square up	Same as in A. B. C.
C. A. B.	One cell to right in next square up	One cell up in next square up	Same as in A. B. C.
C. B. A.	Same as in B. C. A.	Same as in C. A. B.	Same as in A. B. C.
B. A. C.	Same as in A. B. C.	Same as in B. C. A.	Same as in A. B. C.
A. C. B.	Same as in C. A. B.	Same as in A. B. C.	Same as in A. B. C.

with the rule. Fig. II shows this cube with the numbers changed to their three-figure values from which five variations of Fig. 10 may be derived, or they may be constructed

	A	B	C	A	B	C	A	B	C	
<i>Top Square</i>	1	1	1	2	3	2	3	2	3	1 <sup>st</sup> Line
	2	2	3	3	1	1	1	3	2	2 <sup>nd</sup> .
	3	3	2	1	2	3	2	1	1	3 <sup>rd</sup> .
<i>Middle Square</i>	3	2	2	1	1	3	2	3	1	1 <sup>st</sup> Line
	1	3	1	2	2	2	3	1	3	2 <sup>nd</sup> .
	2	1	3	3	3	1	1	2	2	3 <sup>rd</sup> .
<i>Bottom Square</i>	2	3	3	3	2	1	1	1	2	1 <sup>st</sup> Line
	3	1	2	1	3	3	2	2	1	2 <sup>nd</sup> .
	1	2	1	2	1	2	3	3	3	3 <sup>rd</sup> .

FIG. 11.

directly by the directions which are marked in the diagram with the changes of A. B. C. for convenient reference.

The analysis of the numbers in Fig. 1 and Fig. 10 into their three-figure values in terms of 1, 2, 3, as shown in Figs. 4 and 11, makes clear the curious mathematical order of their arrangement which is not apparent on the face of the regular numbers as they appear in the various cells of the cubes. For example, it may be seen that in every subsquare in Figs. 4 and 11 (corresponding to horizontal columns in the cubes) the numbers 1, 2, 3 are each repeated three times. Also in every horizontal and perpendicular column there is the same triple repetition. Furthermore, all the diagonal columns in the cubes which sum up to 42, if followed into their analyses in Figs. 4 and 11 will also be found to carry similar repetitions. A brief study of these figures will also disclose other curious mathematical qualities pertaining to their intrinsic symmetrical arrangement.

The next odd magic cube in order is  $5 \times 5 \times 5$ , and Fig. 12 shows one of its many possible variations. For convenience, it is divided into five horizontal sections or

DIRECTIONS FOR CONSTRUCTING THE  $3 \times 3 \times 3$  MAGIC CUBE SHOWN IN FIG. 10, AND FIVE VARIATIONS OF THE SAME.

COMBINATIONS	ADVANCE MOVES	N BREAKMOVES	N <sup>2</sup> BREAKMOVES
A. B. C.	One cell to left in next square up	One cell in upward left-hand diagonal, in next square down	One cell in downward right-hand diagonal in next square down
B. C. A.	Three consecutive cells in upward left-hand diagonal in same square	One cell in upward right-hand diagonal in next square up	Same as in A. B. C.
C. A. B.	One cell up in next square up	One cell in downward left-hand diagonal in next square up	Same as in A. B. C.
C. B. A.	Same as in B. C. A.	Same as in C. A. B.	Same as in A. B. C.
B. A. C.	Same as in A. B. C.	Same as in B. C. A.	Same as in A. B. C.
A. C. B.	Same as in C. A. B.	Same as in A. B. C.	Same as in A. B. C.

layers, forming five  $5 \times 5$  squares from the top to the bottom of the cube.

Commencing with 1 in the first cell of the middle horizontal column in the third square, this cube may be constructed by filling in the various cells with consecutive numbers up to 125 in accordance with the following directions:



In the five vertical squares from front to back of this cube there are:

- a. 50 straight columns summing up to ..... 315
- b. 6 corner diagonal columns summing up to 315
- c. 20 sub-diagonal columns summing up to.. 315

Total 76 columns having the same summation.

In the five vertical squares from right to left of cube, there are, as in the last case, 76 columns which all sum up to 315. In the complete cube there are also four diagonal columns which unite the eight corners that sum up to 315.

A table similar to Fig. 3 may be laid out giving three-figure values for the numbers in  $5 \times 5 \times 5$  cubes from 1 to 125, and by changing the numbers in Fig. 12 to these

TABLE II.

Prime Nos.	1	2	3	4	5	Section 1.
Key Nos.	0	5	10	15	20	
Prime Nos.	1	2	3	4	5	Section 2.
Key Nos.	25	30	35	40	45	
Prime Nos.	1	2	3	4	5	Section 3.
Key Nos.	50	55	60	65	70	
Prime Nos.	1	2	3	4	5	Section 4.
Key Nos.	75	80	85	90	95	
Prime Nos.	1	2	3	4	5	Section 5.
Key Nos.	100	105	110	115	120	

FIG 13.

three-figure values, a square similar to Fig. 4 will be produced from which five variations of Fig. 12 may be derived. Similar results, however, can be obtained with less work by means of a table of key numbers constructed as shown in Fig. 13. (Table II.)

The three-figure values of cell numbers in  $5 \times 5 \times 5$  magic cubes are found from this table as follows:

Select the key-number which is nearest to the cell-number, but *below it in value*. Then write down

1. The section number in which the key number is found,
2. The prime number over the key-number,

DIRECTIONS FOR CONSTRUCTING THE  $5 \times 5 \times 5$  MAGIC CUBE SHOWN IN FIG. 12, AND FIVE VARIATIONS OF THE SAME.

COMBINATIONS	ADVANCE MOVES	N BREAKMOVES	N <sup>2</sup> BREAKMOVES
A. B. C.	One cell up in next square down	Two cells to left and one down in same square as last entry	One cell to right in same square as last entry
B. C. A.	Two cells to left and one up for five consecutive numbers in same square	Two cells in upward left hand diagonal in next square down	Same as in A. B. C.
C. A. B.	Two cells in left hand downward diagonal in next square up	One cell in right-hand downward diagonal in next square up	Same as in A. B. C.
C. B. A.	Same as in B. C. A.	Same as in C. A. B.	Same as in A. B. C.
B. A. C.	Same as in A. B. C.	Same as in B. C. A.	Same as in A. B. C.
A. C. B.	Same as in C. A. B.	Same as in A. B. C.	Same as in A. B. C.

1	82
74	5
117	72
40	110
83	33

33	110
76	32
24	80
67	23
115	60

3. The difference between the key-number and the cell-number.

Three figures will thus be determined which will represent the required three-figure value of the cell-number.

*Examples.* The first number in the first row of the upper square in Fig. 12 is 67. The nearest key number to this and below it in value is 65 in section 3 under the prime number 4 and the difference between the key-number and the cell-number is 2. The three-number value of 67 is therefore 3. 4. 2. Again, the fourth number in the same row is 10. The nearest key-number but *below it in value* is 5 in section 1 under the prime number 2 and the difference between the key-number and the cell-number is 5. The three-figure value of 10 is therefore 1.2.5. By these simple operations the three-figure values of all the cell numbers in the  $5 \times 5 \times 5$  cube in Fig. 12 may be quickly

1.

1	82	38	119	75
74	5	81	37	118
117	73	4	85	36
40	116	72	3	84
83	39	120	71	2

TOP SQUARE.

3.

65	16	97	28	109
108	64	20	96	27
26	107	63	19	100
99	30	106	62	18
17	98	29	110	61

5.

124	55	6	87	43
42	123	54	10	86
90	41	122	53	9
8	89	45	121	52
51	7	88	44	125

BOTTOM SQUARE.

2.

33	114	70	21	77
76	32	113	69	25
24	80	31	112	68
67	23	79	35	111
115	66	22	78	34

4.

92	48	104	60	11
15	91	47	103	59
58	14	95	46	102
101	57	13	94	50
49	105	56	12	93

FIG. 14.



determined, and by the system of transposition previously explained, five variations of this cube may be constructed.

The shorter method of building these  $5 \times 5 \times 5$  cubes by the direct process of filling the different cells in regular order with consecutive numbers may, however, be considered by some to be preferable to the more roundabout way as seen in the table on page 400.

Fig. 14 is another example of a  $5 \times 5 \times 5$  magic cube

DIRECTIONS FOR CONSTRUCTING THE  $5 \times 5 \times 5$  MAGIC CUBE SHOWN IN FIG. 14, AND FIVE VARIATIONS OF THE SAME.

COMBINATIONS	ADVANCE MOVES	N BREAKMOVES	N <sup>2</sup> BREAKMOVES
A. B. C.	Two consecutive cells in upward left hand diagonal in next square up	One cell in upward right-hand diagonal in next square up	One cell in downward right-hand diagonal in next square down
B. C. A.	Two cells down in second square down	One cell in downward left-hand diagonal in second square down	Same as in A. B. C.
C. A. B.	Two cells to right in next square up	Two cells in downward right hand diagonal in next square down	Same as in A. B. C.
C. B. A.	Same as in B. C. A.	Same as in C. A. B.	Same as in A. B. C.
B. A. C.	Same as in A. B. C.	Same as in B. C. A.	Same as in A. B. C.
A. C. B.	Same as in C. A. B.	Same as in A. B. C.	Same as in A. B. C.

which is commenced in the upper left-hand corner of the top square, and finished in the lower right-hand corner of the bottom square, the middle number of the series (63) appearing in the center cell of the cube according to rule.

Odd magic cubes may be commenced in various cells other than those shown in the preceding pages, and they may be built up with an almost infinite number of variations. It would, however, be only superfluous and tiresome to amplify the subject further, as the examples already submitted cover all the important points of construction, and may readily be applied to further extensions.

Any sizes of odd magic cubes larger than  $5 \times 5 \times 5$  may be constructed by the directions which govern the formation of  $3 \times 3 \times 3$  and  $5 \times 5 \times 5$  cubes.

#### EVEN MAGIC CUBES.

Magic cubes of even numbers may be built by the aid of geometric diagrams, similar to those illustrated in a previous article, which described the construction of even magic squares.

Fig. 15 shows one of the many possible arrangements of a  $4 \times 4 \times 4$  cube, the diagram of which is given in Fig. 16.

There are fifty-two columns in this cube which sum up to 130, viz., sixteen vertical columns from the top of the cube to the bottom, sixteen horizontal columns from the front to the back, sixteen horizontal columns from right to left, and four diagonal columns uniting the four pairs of opposite corners. The sum of any two numbers, which are diametrically opposite to each other and equidistant from the center of the cube also equals 65 or  $n^3 + 1$ .

Another feature of this cube is that the sum of the four numbers in each of the forty-eight sub-squares of  $2 \times 2$  is 130.

It was shown in a previous article on magic squares

(Top.) Section I.	1	63	62	4
	60	6	7	57
	56	10	11	53
	13	51	50	16

Section II.	48	18	19	45
	21	43	42	24
	25	39	38	28
	36	30	31	33

Section III.	32	34	35	29
	37	27	26	40
	41	23	22	44
	20	46	47	17

Section IV. (Bottom.)	49	15	14	52
	12	54	55	9
	8	58	59	5
	61	3	2	64

FIG. 15.

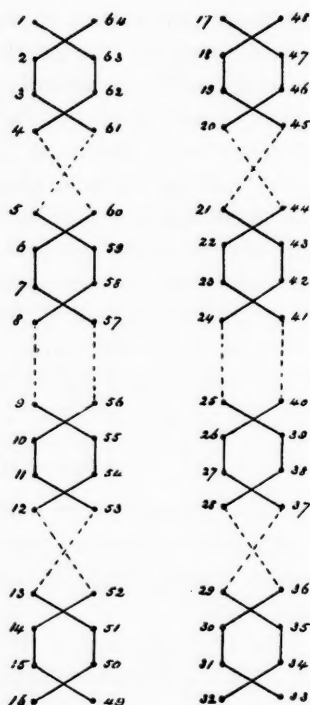


FIG. 16.

Totals = 130.

that the square of  $4 \times 4$  could be formed by writing the numbers 1 to 16 in arithmetical order, then leaving the numbers in the two corner diagonals unchanged, but changing all the other numbers to their complements with 17 or  $n^2 + 1$ . It will be noted in the magic cube of  $4 \times 4 \times 4$ , given in Fig. 15, that in the first and last of the four sections (I and IV) this rule also holds good. In the two middle sections (II and III) the rule is reversed; the numbers in the two corner diagonals being complements with

65 or  $n^3+1$ , and all the other numbers in arithmetical order.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32

33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48

49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64

FIG. 17.

Fig. 17 shows four squares or sections of a cube, with the numbers 1 to 64 written in arithmetical order. Those numbers that occupy corresponding cells in Fig. 15 are enclosed within circles. If all the other numbers in Fig. 17 are changed to their complements with 65, the total arrangement of numbers will then be the same as in Fig. 15.

In his interesting and instructive "Reflections on Magic Squares," (printed in the January number of *The Monist*) Dr. Paul Carus gives a novel and ingenious analysis of even squares in different "orders" of numbering, these orders being termed respectively *o*, *ro*, *i* and *ri*. It is shown that the two magic squares of  $4 \times 4$  (in article referred to) consist only of *o* and *ro* numbers; *ro* numbers being in fact the complements of *o* numbers with  $n^2+1$ . This rule also obtains in the magic cube of  $4 \times 4 \times 4$  given in Fig. 15. The four sections of this cube may in fact be filled out by writing the *o* numbers, in arithmetical order in the cells of the two corner diagonal columns of sections I and IV, and in all the cells of sections II and III, excepting those of the two corner diagonal columns, and then writing the *ro* numbers, also in arithmetical order, in the remaining empty cells of the four sections.

Fig. 15 may be considered as the foundation of all magic cubes of  $4 \times 4 \times 4$  and their multiples, of this class,

but a great many variations may be effected by simple transpositions. For example, Fig. 18 is a  $4 \times 4 \times 4$  cube which is constructed by writing the four numbers that are contained in the  $2 \times 2$  sub-squares (Fig. 15) in a straight line, and there are many other possible transpositions which will change the relative order of the numbers, without destroying the magic characteristics of the cube.

The arrangement of the numbers in Fig. 18 follows the diagrammatic order shown in Fig. 19.

Section I. (Top.)	1	63	60	6
	62	4	7	57
	56	10	13	51
	11	53	50	16

Section II.	48	18	21	43
	19	45	42	24
	25	39	36	30
	38	28	31	33

Section III.	32	34	37	27
	35	29	36	40
	41	23	20	46
	22	44	47	17

Section IV. (Bottom.)	49	15	12	54
	14	52	55	9
	8	58	61	3
	59	5	2	64

FIG. 18.

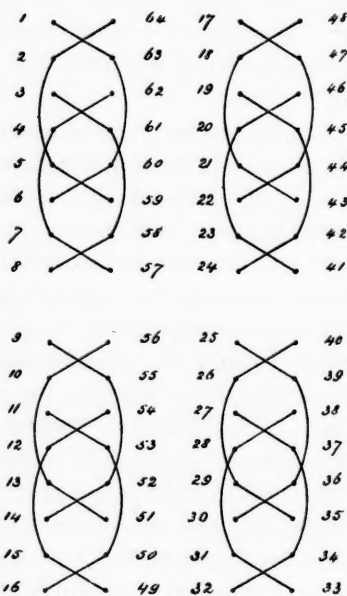


FIG. 19.

Totals = 130.

The next even magic cube is  $6 \times 6 \times 6$ , but the writer has been unable to construct it. He does not however believe it to be a mathematical impossibility.

The  $8 \times 8 \times 8$  magic cube follows next in order. Fig. 20 shows this cube divided, for convenience, into eight horizontal layers or sections, and Fig. 21 gives the diagrammatic order of the numbers in the first and eighth sections, the intermediate sections being built from similar diagrams, numbered in arithmetical order.

It will be seen from these diagrams that the  $8 \times 8 \times 8$  magic cube is simply an expansion of the  $4 \times 4 \times 4$  cube,

1	511	510	4	5	507	506	8
504	10	11	501	500	14	15	497
496	18	19	493	492	22	23	489
25	487	486	26	29	483	482	32
33	479	478	36	37	475	474	40
472	42	43	469	468	46	47	465
464	50	51	461	460	54	55	457
57	455	454	60	61	451	450	64

Section I.

354	130	131	381	380	134	135	377
137	375	374	140	141	371	370	144
145	367	366	148	149	363	362	152
360	154	155	357	356	158	159	353
352	162	163	349	348	166	167	345
169	343	342	172	173	339	338	176
177	335	334	180	181	331	330	184
328	186	187	325	324	190	191	321

Section III.

448	66	67	445	444	70	71	441
73	439	438	76	77	435	434	80
81	431	430	84	85	427	426	88
429	90	91	421	420	94	95	417
416	98	99	413	412	102	103	409
105	407	406	108	109	403	402	112
113	399	398	116	117	395	394	120
392	122	123	389	388	126	127	385

Section II.

193	319	318	196	197	315	314	200
312	202	203	309	308	206	207	305
304	210	211	301	300	214	215	297
217	295	294	220	221	291	290	224
225	287	286	228	229	283	282	232
230	234	235	277	276	238	239	273
272	242	243	269	268	246	247	265
249	263	262	252	253	259	258	256

Section IV.

(First Part.)  
FIG. 20.

just as the  $8 \times 8$  magic square is an expansion of the  $4 \times 4$  square. In like manner all the diagrams which were given for different arrangements of  $8 \times 8$  magic squares may also be employed in the construction of various  $8 \times 8 \times 8$  magic cubes.

257	255	254	260	261	251	250	262
248	266	267	245	244	270	271	247
240	274	275	257	266	272	279	233
221	231	230	224	225	227	226	228
219	223	222	222	223	223	218	226
216	228	229	213	212	202	203	209
201	206	207	205	204	210	211	201
203	199	198	216	217	195	194	220

Section V.

128	326	317	125	124	330	331	121
393	119	118	396	397	115	114	400
401	111	110	404	405	107	106	408
104	410	411	101	100	414	413	97
96	418	419	93	92	422	423	89
425	87	86	428	429	83	82	422
433	79	78	436	437	75	74	440
72	442	443	69	68	446	447	65

Section VII.

192	322	323	119	118	326	327	115
329	113	112	332	333	179	178	336
337	175	174	340	341	171	170	344
168	346	347	165	164	350	351	161
160	354	355	157	156	352	353	153
361	151	150	364	365	147	146	368
369	143	142	372	373	139	138	376
136	378	379	133	132	382	383	129

Section VI.

449	63	62	452	453	59	58	458
56	454	455	53	52	462	463	49
48	466	467	45	44	470	471	41
473	39	38	476	477	35	34	480
481	31	30	484	485	27	26	488
24	490	491	21	20	494	495	17
16	498	499	13	12	502	503	9
505	7	6	508	509	3	2	512

Section VIII.

(Second Part.)

FIG. 20.

An examination of Fig. 20 will show that, like the  $4 \times 4 \times 4$  cube in Fig. 15 it is built up of *o* and *ro* numbers exclusively. In sections I, IV, V, and VIII, the cells in the corner diagonal columns, and in certain other cells which are placed in definite geometrical relations thereto,



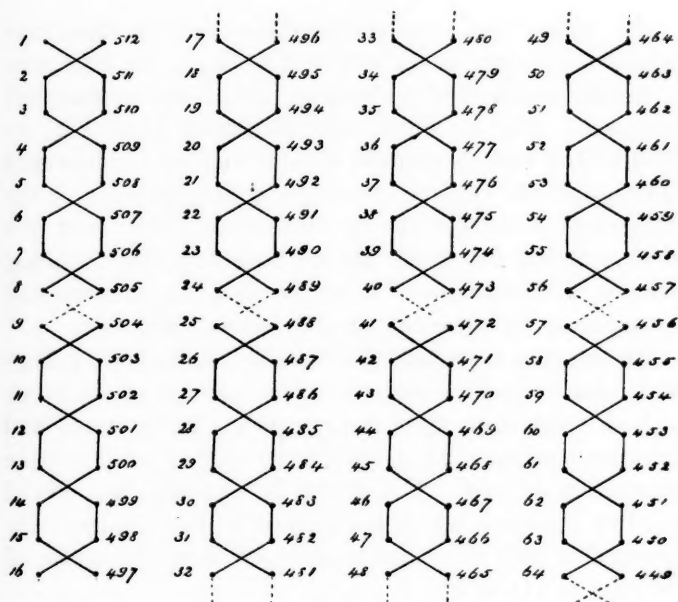


FIG. 21.

contain *o* numbers, while all the other cells contain *ro* numbers. In sections II, III, VI, and VII, the relative positions of the *o* and *ro* numbers are reversed.

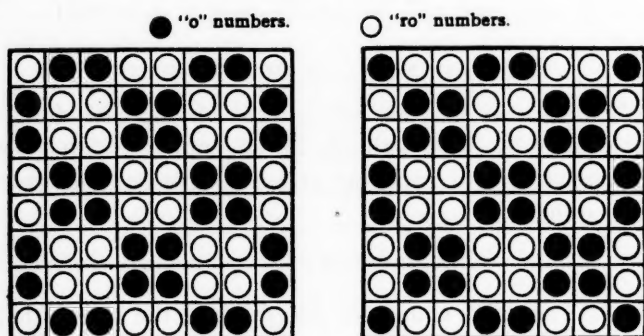


FIG. 22.

By noting the symmetrical disposition of these two orders of numbers in the different sections, the cube may be readily constructed without the aid of any geometrical diagrams. Fig. 22 shows sections I and II of Fig. 20 filled with *o* and *ro* symbols without regard to numerical values, and the relative symmetrical arrangement of the two orders is therein plainly illustrated. This clear and lucid analysis, for which we are indebted to Dr. Carus, reduces the formation of a rather complicated numerical structure to an operation of the utmost simplicity.

In this cube there are 192 straight columns, and 4 diagonal columns (which unite the eight corners of the cube) each of which sums up to 2052; also 384 half columns and the same number of  $2 \times 2$  sub-squares each of which has the summation of 1026. It will also be seen that the sum of any two numbers, which are located in cells diametrically opposite to each other and equidistant from the center of the cube, is  $513$  or  $n^3 + 1$ .

As the writer has been unable to construct the  $6 \times 6 \times 6$  magic cube no attempt will be made in this article to produce a  $10 \times 10 \times 10$  or any larger cube of this peculiar class. The  $12 \times 12 \times 12$  cube and all larger ones that are formed with multiples of 4 will naturally resemble the  $8 \times 8 \times 8$  cube and will be equally easy to construct.

#### GENERAL NOTES ON MAGIC CUBES.

Magic cubes may be constructed having any desired summations by using suitable initial numbers with given increments, or by applying proper increments to given initial numbers.

\* \* \*

The general formula for determining the summations or column values of magic cubes as already given on page 389 may be copied here for convenient reference.

Let  $A$  = initial number,

$B$  = increment,

$N$  = number of cells in each column of cube,

$S$  = summation,

then:

$$I \quad \frac{N}{2} [B(N^3-1)+2A]=S$$

and transposing:

$$II \quad \frac{\frac{2S}{N}-2A}{N^3-1}=B.$$

or:

$$III \quad \frac{\frac{2S}{N}-B(B^3-1)}{2}=A$$

#### EXAMPLES.

What increment number is required for the cube of  $3 \times 3 \times 3$  with an initial number of 10 to produce summations of 108?

Expressing equation II in figure values:

$$\frac{\frac{2 \times 108}{3}-2 \times 10}{3^3-1}=2.$$

28	16	20
56	10	42
24	38	46

54	14	40
22	36	50
32	58	18

26	34	48
30	62	16
52	12	44

What increments should be used in a cube of  $4 \times 4 \times 4$  to produce summations of 704 if the initial number is 50?

$$\frac{\frac{2 \times 704}{4}-2 \times 50}{4^3-1}=4.$$

50	298	294	62
286	70	74	274
270	86	90	258
98	250	246	110

Section I (Top).

238	118	122	226
130	218	214	142
146	202	198	158
190	166	170	178

Section II.

174	182	156	162
194	154	150	206
210	138	134	222
126	230	234	114

Section III.

242	106	102	254
94	262	266	82
98	278	282	66
290	58	54	302

Section IV (Bottom).

What initial number must be used with increments of 10 to produce summations of 1906 in a  $3 \times 3 \times 3$  cube?

Expressing equation III in figure values:

$$\frac{2 \times 1906}{3} - 10(3^3 - 1) = 505\frac{1}{3}.$$

595 $\frac{1}{3}$	755 $\frac{1}{3}$	555 $\frac{1}{3}$
735 $\frac{1}{3}$	505 $\frac{1}{3}$	665 $\frac{1}{3}$
575 $\frac{1}{3}$	645 $\frac{1}{3}$	615 $\frac{1}{3}$

Top Section.

725 $\frac{1}{3}$	525 $\frac{1}{3}$	655 $\frac{1}{3}$
565 $\frac{1}{3}$	635 $\frac{1}{3}$	705 $\frac{1}{3}$
615 $\frac{1}{3}$	745 $\frac{1}{3}$	545 $\frac{1}{3}$

Middle Section.

585 $\frac{1}{3}$	625 $\frac{1}{3}$	635 $\frac{1}{3}$
605 $\frac{1}{3}$	765 $\frac{1}{3}$	535 $\frac{1}{3}$
715 $\frac{1}{3}$	515 $\frac{1}{3}$	675 $\frac{1}{3}$

Bottom Section.

What initial number is required for the cube of  $5 \times 5 \times 5$ , with 4 as increment number, to produce summations of 1906?\*

$$\frac{2 \times 1906}{5} - 4(5^3 - 1) = 133.2$$

\* \* \*

The preceding simple examples will be sufficient to illustrate the formulæ given, and may suggest other problems to those who are interested in the subject.

It will be noted that the magic cubes which have been

\* This example was contributed by Mr. D. B. Ventres of Haddam, Conn., whom the writer takes this opportunity to thank for many interesting suggestions and ideas.

described in this article are all in the same general class as the magic squares which formed the subject of previous articles.

397.2	521.2	545.2	169.2	273.2
569.2	179.2	297.2	421.2	445.2
321.2	345.2	469.2	573.2	197.2
473.2	597.2	221.2	245.2	369.2
145.2	269.2	373.2	497.2	621.2

Section I (Top).

553.2	177.2	301.2	425.2	449.2
325.2	349.2	453.2	577.2	201.2
477.2	601.2	285.2	249.2	353.2
149.2	253.2	377.2	501.2	625.2
401.2	525.2	549.2	153.2	277.2

Section II.

329.2	333.2	457.2	581.2	205.2
481.2	605.2	229.2	233.2	357.2
133.2	257.2	381.2	505.2	629.2
403.2	529.2	533.2	157.2	281.2
557.2	181.2	305.2	429.2	433.2

Section III.

485.2	609.2	213.2	237.2	361.2
137.2	261.2	385.2	509.2	613.2
409.2	573.2	537.2	161.2	285.2
561.2	185.2	309.2	413.2	437.2
313.2	337.2	461.2	585.2	209.2

Section IV.

141.2	265.2	389.2	493.2	617.2
393.2	517.2	541.2	165.2	289.2
565.2	189.2	293.2	417.2	441.2
317.2	341.2	465.2	589.2	193.2
459.2	593.2	217.2	241.2	365.2

Section V.

There are, however, many classes of magic squares and corresponding cubes which differ from these in the general

arrangement of numbers and in various minor features, while retaining the common characteristic of having similar column values. An example of this differentiation is seen in the interesting "Jaina" square described by Dr. Carus in his "Reflections on Magic Squares." Squares of this class can readily be expanded into cubes which will naturally carry with them the peculiar features of the squares.

Another class is illustrated in the "Franklin Squares," and these can also be expanded into cubes constructed on the same general principles.

The subject of magic squares and cubes is indeed inexhaustible and may be indefinitely extended. The philosophical significance of these studies has been so ably set forth by Dr. Carus that the writer feels unable to add anything in this connection, but he trusts that the present endeavor to popularize these interesting problems may some time lead to useful results.

W. S. ANDREWS.

SCHENECTADY, N. Y.

## THE NUMBER $\pi$ IN CHRISTIAN PROPHECY.

RELIGION everywhere consists of that set of sentiments which is inspired by man's world-conception, and the great significance of religion appears in its application to conduct, especially toward the powers that are supposed to sway our destinies. Religion, accordingly, is the product of the most impressive knowledge of the age in which its doctrines have originated, and being of a conservative nature, it is natural for it to always lag behind the progress of the times. Authority is a great factor in religion; and thus it happens that established authority which cannot but be the authority of the past, predominates over the authority of the present, represented in the maturest knowledge of the day.

How much of the science of a very distant past is contained in some of the factors that shaped Christianity, will appear from the following consideration of the echo of mathematical knowledge which has reached us in mystical and distorted prophecies, while the original idea is still traceable in the different modes of its manifestations. It is the number of the cycle of an age, or any time represented by a circle, in which life begins a new era repeating cyclical events.

The most obvious cycle in the course of earthly affairs is the year, and the events of one year approximately predict the happenings of all others. The same may be said of the phases of the moon and of the daily course of the sun.



Time rolls in cycles, and the most significant number for calculating the length of a cycle is the number which represents the relation of the diameter of a circle to its circumference. This number, which since the days of Greece has been called  $\pi$  (as the initial of the Greek word *periphēreia*\*) was approximated in very primitive times in the number  $3\frac{1}{2}$  or seven halves, and it is rather surprising that our biblical exegetists have not stumbled on it in the explanation of the several passages which have so far proved a perplexity to interpretation. In fact, the writer of these lines once communicated his suggestion to a very prominent scholar of eschatological literature, who discarded it with an incredulous smile, declaring that evidence was missing. Yet any one who will consider the several passages in question will agree that the number  $3\frac{1}{2}$  which is met with so frequently in the book of Daniel, the Revelation of St. John, and other prophetic books (especially those that deal with eschatological subjects) can only refer to the number of the cycle, and it can scarcely be doubted that *three times and a fraction* as well as *after three days* which means three full days and a little more, are nothing else but expressions of the same idea.

It seems that most of the prophets firmly believed in the reliability of the number  $\pi$ , counted as  $3\frac{1}{2}$  (or approximately  $3\frac{1}{2}$ ) and their difficulties consisted simply in their attempts to make their calculations agree with facts. They were not sure whether to compute the number of a period in hours, days, months, lunar years or solar years; whether or not to consider leap-days and leap-months etc., but the idea of the number of the cycle is obviously uppermost in their minds in all their mystical references to any periods of time.

The number of the cycle is expressed in a mysterious form as  $1+2+\frac{1}{2}$ . It is unity plus duality plus unity

\* περιφέρεια.

divided by duality. In another place it is called "one thousand three hundred and three score days," which is simply three and a half years when the year is counted according to ancient Babylonian fashion as 360 days, the five and a fraction additional days being considered super-numerary.

In the Revelation of St. John (xi, 3) we read:

"And I will give power unto my two witnesses, and they shall prophesy a *thousand two hundred and three score* days, clothed in sackcloth."

The same story continues, with reference to another period of three days and a half (verses 7, 9 and 11):

"When they shall have finished their testimony, the beast.... shall overcome them and kill them.... And they of the people and kindreds and tongues and nations shall see their dead bodies *three days and an half*, and shall not suffer their dead bodies to be put in graves.... And after *three days and an half* the Spirit of life from God entered into them, and they stood upon their feet."

In Daniel xii. 7 we read concerning the period of Israel's tribulation:

"And I heard the man clothed in linen, which was upon the waters of the river, when he held up his right hand and his left hand unto heaven, and sware by him that liveth for ever that it shall be for *a time, times, and an half*; and when he shall have accomplished to scatter the power of the holy people, all these things shall be finished."

"A time, times, and an half" are three and a half, (the plural "times" standing for the simplest plural number which is "two"), the same period that is allotted, as a respite from the persecutions of the dragon, to the woman who is to bear the apocalyptic Christ (Rev. xii, 14). There we read:

"And to the woman were given two wings of a great eagle, that she might fly into the wilderness, into her place, where she is nourished for *a time, and times, and half a time*, from the face of the serpent."

The woman is persecuted by the dragon and stays in the desert 1260 days, which, as we have seen, is three years and a half.

The number  $\pi$  appears frequently in the Apocryphal books, especially the book of Enoch, and the fourth book of Esdras. In Esdras xiv, 10 ff., the number  $10\frac{1}{2}$  plays the same part and this is simply a multiple of  $3\frac{1}{2}$  by 3.

The numbers 1290, 1335 and 2300 which also occur in various prophecies, are only other computations of the number of the cycle on the basis of different principles. The last mentioned is found in Daniel viii, 14, where we read:

"And he said unto me, Unto *two thousand and three hundred days*; then shall the sanctuary be cleansed."

The translation here is not exact, and perhaps cannot be, for the text is corrupt and there are many variants. At any rate 2300 days would be twice three years and a fraction, if the moon year is made the basis of calculation, and so contains the number  $\pi$ . But according to one variant (preferred by Professor Hilgenfeld\*) the meaning appears to be "2300 evenings and mornings," implying that there are 1150 days in which the sanctuary shall remain uncleansed.

The number  $\pi$  (three and a fraction) is expressed in the phrase "after three days," and with this idea it is also mentioned in the book of Jonah where we read (i. 17) that the prophet "was in the belly of the fish *three days and three nights*." He came out after three full days and nights, viz., on the fourth day, and the incident is referred to by Jesus himself when prophesying his resurrection (Matt. xii. 40):

\* For Professor Hilgenfeld's view on the subject see *Die jüdische Apokalypic*, pp. 32-33. Though he repeatedly mentions prophecies containing the number  $3\frac{1}{2}$ , it is strange that he never thinks of its being the number of the cycle.

"For as Jonas was *three days and three nights* in the whale's belly; so shall the Son of man be *three days and three nights* in the heart of the earth."

Paul says similarly in Corinthians xv. 4, "he rose again the third day," but here we must bear in mind that a variant reads "after the third day," and it is very probable that the now rejected variant is the original reading. It is natural that as soon as Sunday had come to be regarded as the day of resurrection, and Friday was celebrated as the crucifixion day, the alteration should be made to conform to established church festivals.

Mathematical knowledge, so very important in ancient Babylon, was not cultivated among the early Christians, and hence the original meaning of the number three and a fraction had faded from their minds. Otherwise the Christian church festivals would probably have been so adjusted as to make the period of Christ's sojourn in the domain of death, conform to the traditional notion of a cycle. Christ's death might have been ascribed to Wednesday, or his resurrection to Tuesday, but the former would have disassociated this event from the paschal feast, while the latter would have canceled the only sanction for Christians to celebrate Sunday.

If Christ's own prophecy did not contain the quotation from Jonah, it would most probably have been modified by copyists so as to suit the established church ritual. The accessibility of the original passage preserved the text in spite of the non-conformity with the established fixation of days.

It was highly significant to the early Christians that Christ died as the paschal lamb, and so the Gospels reiterate the statement that the passion took place in the beginning of the paschal feast. A little later when the Lord's Supper began to be celebrated in commemoration of Christ's death, the Saviour was naturally regarded as the

founder of the rite which necessitated the assumption of his having the paschal meal with his disciples. This would fix the date of the crucifixion on Saturday, and reduce Christ's sojourn in hell to one night only, for if there was a thing regarded as firmly established in the Gentile church, it was the belief that the Saviour had risen on a Sunday.

Persian influences, we must remember, were very strong among the Jews of post-exilic times, and the pious sectarians were greatly affected by them. Sunday was then the great festive day of the Mithraists, and the disciples of St. John as well as the Nazarenes celebrated the day by coming together and breaking bread in a common meal. Accordingly, Sunday, the day of Mithras, was considered the fittest day to become the day of the Lord, just as the birthday of Mithras was selected as the most appropriate day for the celebration of Christ's birthday. That Sunday was celebrated prior to Christianity is unquestionably proved by the fact that St. Paul visits in the several cities those circles of "disciples" who had neither heard of the Holy Ghost, nor believed as yet on Christ Jesus (Acts xix. 1-4), and they used to break bread in common on the first day of the week.\*

A compromise between these colliding considerations resulted in setting aside Christ's prophecy "after three days"; but since a dim awe of the significance of the number three was still haunting the imagination of the early Church, the phrase, "after three days" was replaced by the words "on the third day" which suited the occasion, and though it meant something different from the ancient formula, still preserved the mystic ring.

It would become monotonous to follow up all the mys-

\* Cf. also Acts xviii. 25. Simon Magus and Apollos were preachers of a religion that had much in common with Paul's Christianity, but neither of them had heard of Jesus. We must assume that they had many beliefs and customs in common with the early Christians.

tical computations that have been employed to calculate the several periods which were of importance to the religious minds of that age of messianic expectations, but we may be sure that almost everywhere there lurks an approximation of the number  $\pi$  at the bottom of all designations of time which represent a cycle of some kind; the time of tribulation, the time of the desecration of the temple, the time of the triumph of the enemies of Israel, the time of death before resurrection, etc. It is not impossible even, that the millennium is merely the multiplication of a period of 300 day-years by three and a fraction, resulting in the round number 1000, analogous to the computation of 3 times  $3\frac{1}{2}$ , occurring in Esdras.

To us of a later generation, these calculations have become unmeaning, and it is perhaps hard to understand how they could have possessed so much significance to the authors of Daniel, Esdras and the Revelation. We must bear in mind, however, that the underlying principle of this antiquated logic is not wrong and is still recognized by modern science; it is simply the thought that all events are subject to law, and that by knowing the law, we can presage what the future will reveal.

EDITOR.

## CRITICISMS AND DISCUSSIONS.

### MAGIC SQUARES AND PYTHAGOREAN NUMBERS.

"I have compiled this discourse, which asks for your consideration and pardon not only because the matter itself is by no means easy to be handled, but also because the doctrines herein contained are somewhat contrary to those held by most of the Platonic philosophers." *Plutarch.*

The fascinating series of articles upon "Magic Squares" by Mr. W. S. Andrews and the interesting "Reflections" upon the same by the Editor in recent numbers of *The Monist* have induced me to make a few comments upon a subject in which I have long been interested,—that of the relationship between magic squares and certain Pythagorean numbers.

The mysterious relationships of numbers have attracted the minds of men in all ages. The many-sided Franklin, whose 200th anniversary the philosophical, scientific, and literary worlds have recently celebrated, used to amuse himself with the construction of magic squares and in his memoirs has given an example of his skill in this direction, by showing a very complicated compound square with the comment that he believes the same to be the most magical magic square yet constructed by any magician. I would therefore attribute the discovery of compound magic squares to Franklin rather than to Professor Schubert as suggested by Mr. Andrews.

That magic squares have had in centuries past a deeper meaning for the minds of men than that of simple mathematical curios we may infer from the celebrated picture by Albert Dürer entitled "Melancolia," engraved in 1514. The symbolism of this engraving has interested to a marked degree almost every observer. The figure of the brooding genius sitting listless and dejected amid her uncompleted labors, the scattered tools, the swaying balance, the flow-



ing sands of the glass, and the magic square of 16 beneath the bell, —these and other details reveal an attitude of mind and a connection of thought, which the great artist never expressed in words, but left for every beholder to interpret for himself.



MELANCHOLY.

The discovery of the arrangement of numbers in the form of magic diagrams was undoubtedly known to the ancient Egyptians and this may have formed part of the knowledge which Pythagoras brought back from his foreign travels. We have no direct evidence

that the Pythagorean philosophers in their studies of the relationship of numbers ever combined them into harmonic figures, yet the supposition that they did so is not at all improbable. Such diagrams and their symbolic meanings may well have formed part of the arcana of the esoteric school of Pythagoras, for similar facts were accounted by ancient writers as constituting a part of the aporrheta of the order and the story is told of an unworthy disciple who revealed the secret of the construction of the dodecahedron inscribed within a sphere, this being a symbol of the universe.

Among the best expositions of the Pythagorean philosophy are sections of the "Timæus" and "Republic" of Plato. These dialogues were written after Plato's return from Magna Græcia, where from contact with Archytas of Tarentum and other philosophers, he imbibed so much of the Italian school that his whole system of philosophy became permeated with Pythagorean ideas. It is even suggested that he incorporated into these dialogues parts of the lost writings of Philolaus, whose works he is known to have purchased. No portions of the dialogues named have been more puzzling to commentators than the vague references to different numbers, such as the number 729, which is chosen to express the difference between the kingly man and the tyrant, or the so-called number of the State in the "Republic," or the harmonic number of the soul in the "Timæus" of which Plutarch said that "it would be an endless toil to recite the contentions and disputes that have from hence arisen among his interpreters." Either our text of these passages is corrupt or Plato is very obscure, throwing out indirect hints which would be intelligible only to those previously informed. Plato states himself in the "Phædrus" that "all writings are to be regarded purely as a means of recollection for him who already knows," and he, therefore, probably wrote more for the benefit of his hearers than for distant posterity.

It is upon the principle of a magic square that I wish to interpret the celebrated passage in the "Republic" referring to the number 729, proceeding from this to a discussion of certain other numbers of peculiar significance in the Pythagorean system. My efforts in this direction are to be regarded as purely fanciful; the same may be said, however, of the majority of other methods of interpretation.

The passage from the "Republic" referred to (Book IX, § 587-8, Jowett's translation) reads as follows:

*Socrates.* "And if a person tells the measure of the interval which separates the king from the tyrant in truth of pleasure, he

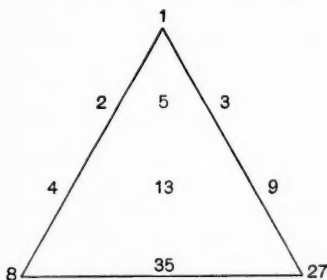
will find him, when the multiplication is completed living 729 times more pleasantly, and the tyrant more painfully by this same interval."

*Glancon.* "What a wonderful calculation."

*Socrates.* "Yet a true calculation and a number which closely concerns human life, if human life is concerned with days and nights and months and years."

The number 729 is found to be of great importance all through the Pythagorean system. Plutarch states that this was the number belonging to the sun, just as 243 was ascribed to Venus, 81 to Mercury, 27 to the moon, 9 to the earth, and 3 to Antichthon (the earth opposite to ours). These and many similar numbers were derived from one of the progressions of the Tetractys,—1:2::4:8 and 1:3::9:27. The figures of the above proportions were combined by Plato into one series 1, 2, 3, 4, 9, 8, 27. ("Timæus," § 35). Plutarch in his "Procreation of the Soul," which is simply a commentary upon Plato's "Timæus," has represented the numbers in the form of a triangle; the interior numbers, 5, 13, and 35, representing the sums of the opposite pairs,

were also of great importance. The deep significance of the Tetractys in the system of Pythagoras may be inferred from a fragment of an oath contained in the "Golden Verses."



Ναὶ μὰ τὸν ἀμέτερον ψυχῇ παραδόντα τετρακτὸν  
Παγὰν, δανάου φύσεως ῥιζώματ' ἔχουσιν.

"Yea, by our Tetractys which giveth the soul the fount and source of ever flowing nature!"

Odd numbers were especially favored by the Pythagoreans and of these certain ones such as 3 and its higher powers were considered to have a higher significance than others and in this way, perhaps, arose the distinction between expressible and inexpressible or ineffable numbers (*ἀριθμοὶ ῥητοὶ καὶ ἀῤῥητοι*). Numbers which expressed some astronomical fact also held high places of honor, as may be seen from a statement by Plutarch (*loc. cit.*) in reference to the Tetractys. "Now the final member of the series, which is 27, has this peculiarity, that it is equal to the sum of the preceding numbers (1+2+3+4+9+8); it also represents the periodical num-

ber of days in which the moon completes her monthly course; the Pythagoreans have made it the tone of all their harmonic intervals."

This passage indicates sufficiently the supreme importance of the number 27.

If we construct a magic square  $27 \times 27$  upon the plan of a

362	381	326	439	468	413	274	303	248	613	642	587	700	729	674	535	564	509	118	147	92	205	234	179	40	69	14
323	353	379	414	440	466	249	275	301	588	614	640	675	701	727	510	536	562	93	119	145	180	206	232	15	41	67
380	375	354	467	412	241	302	247	276	641	586	615	728	673	702	553	508	537	146	91	120	233	178	207	68	13	42
277	306	251	355	384	329	433	462	407	538	567	512	616	645	590	694	723	668	43	72	101	150	95	198	226	173	
252	273	304	330	358	382	408	434	460	613	539	565	591	617	643	668	695	721	18	44	70	96	122	148	174	200	226
305	250	276	383	328	357	461	409	435	566	511	540	644	589	618	722	667	696	71	16	45	149	94	123	227	172	201
436	465	410	211	300	245	359	387	332	697	726	671	532	561	506	619	648	593	202	231	176	97	86	111	124	153	88
411	437	463	246	272	298	333	359	385	672	698	724	507	533	559	584	620	646	177	203	229	12	34	64	99	125	151
464	409	438	289	244	273	386	331	360	725	670	699	560	505	534	647	592	621	230	175	204	95	10	39	162	97	126
127	156	101	214	243	188	48	78	23	381	390	335	448	477	422	283	312	267	595	624	569	682	711	656	517	546	491
102	128	164	189	215	241	24	50	76	336	362	388	423	449	476	258	284	310	570	596	622	657	683	709	492	518	544
155	100	129	242	187	216	17	22	51	389	334	363	476	421	450	311	256	285	623	668	597	710	655	684	545	490	519
52	81	26	130	160	104	208	237	182	286	315	260	364	393	338	442	471	416	520	549	494	598	627	572	676	705	650
27	53	79	105	131	157	183	209	235	261	287	313	339	365	391	417	443	469	495	521	547	573	599	625	651	677	703
80	25	54	158	103	132	236	181	210	314	259	288	392	337	366	470	415	444	548	493	522	626	571	600	704	649	678
21	240	78	48	75	20	133	182	107	445	474	419	280	309	254	367	396	341	679	708	653	514	543	488	601	630	575
186	212	238	21	47	73	108	134	160	420	446	472	255	281	307	342	368	394	654	680	706	489	515	541	676	602	628
238	184	213	74	19	48	161	106	135	473	418	447	308	253	282	305	340	369	707	652	681	542	487	516	679	604	633
604	633	578	691	720	665	526	555	500	109	138	83	196	225	170	31	60	5	370	399	344	457	486	431	292	321	266
579	605	631	666	692	718	501	527	553	84	10	136	171	197	223	8	32	58	345	371	397	432	458	484	267	293	319
632	577	606	719	664	693	554	499	528	137	82	111	224	169	198	59	4	33	398	343	372	495	430	459	320	265	294
529	558	503	607	636	581	635	714	659	34	63	8	112	141	86	190	213	164	295	324	269	373	422	347	451	480	425
504	530	556	592	608	634	660	686	712	9	35	91	87	113	139	165	191	217	270	296	322	348	374	400	426	452	478
557	502	531	635	590	609	713	658	687	82	7	36	140	85	114	218	163	192	323	268	297	401	346	375	479	424	453
668	717	692	523	562	487	610	639	584	193	222	167	28	57	2	115	144	69	454	483	428	289	318	263	376	405	350
663	689	715	498	524	550	585	611	637	168	194	220	3	29	55	90	116	142	429	455	481	264	290	316	351	377	403
716	661	690	551	496	525	638	593	612	221	166	195	58	1	30	143	88	117	482	427	456	317	262	291	404	349	378

checker-board—arranging the numbers 1 to 729 first in numerical order, then shifting the 9 largest squares ( $9 \times 9$ ) into the positions indicated in the familiar  $3 \times 3$  square, repeating the process with the subdivisions of the  $9 \times 9$  squares and so on down—we will arrive at the following combination.<sup>1</sup>

It will be noted that we have 365 white squares or days and

<sup>1</sup>This method of constructing compound magic squares is, so far as I know, original with the writer. It bears some resemblance to the method of Schubert (*Monist*, XV, p. 566); the numbers of each square, however, increase in periods of threes instead of by sequence.

364 dark squares or nights—a veritable “checkerboard of nights and days.” The number 365, the days of the solar year, very appropriately occupies the centre of the system. The columns, horizontals, and diagonals of the central square  $3 \times 3$  foot up 1095, or the days of a 3 year period, those of the larger center square  $9 \times 9$  foot up 3285 the days of a 9 year period, while those of the entire combination  $27 \times 27$  foot up 9855,<sup>2</sup> the days of a 27 year period,—in other words, periods of years corresponding to the Tetractys 1, 3, 9, 27. We may with safety borrow the language of Plato and say that the above arrangement of numbers “is concerned with days and nights and months and years.”

The interpretation of the other passage referred to in the “Republic”—the finding of the number of the State—(Book VIII, § 546) has been a subject of the greatest speculation and by consulting the various editions of Plato it will be found that scarcely any two critics agree upon a solution.<sup>3</sup> As Jowett remarks, it is a puzzle almost as great as that of the Beast in the Book of Revelation. Unfortunately we have no starting-point from which to begin our calculations; this and the very uncertain meanings of many of the Greek terms have caused many commentators to give up the solution of the problem in sheer despair. Aristotle, who was a hearer of Plato's, writes as if having a full knowledge of the mystery; Cicero, however, was unable to solve the riddle and his sentiment became voiced in the proverb *numeris Platonis nihil obscurius*.

By taking a hint from our magic square and starting with the number 27, I believe we may arrive at as good a solution of the problem as any that I have seen suggested. The following interpretation of the Greek terms is offered.

αὐξήσεις δυνάμεναι τε καὶ the square of the number times its root,

$$27^2 \times \sqrt[3]{27} = 2187$$

ρῆς ἀποστάσεις increased by thrice the first terms (of the Tetractys)

$$(1+2+3+4+9) \times 3 = 57$$

ἑτταρας δὲ ὄρους λαβοῦσαι and four times the whole series

$$(1+2+3+4+9+8+27) \times 4 = 216$$

<sup>2</sup> Not only the perpendiculars, horizontals, and diagonals of this large square foot up 9855, but there are an almost indefinite number of zig-zag lines, which give the same footing.

<sup>3</sup> Schleiermacher, Donaldson, and Schneider suggest 216, and much may be said in favor of this number. Jowett gives 8000 as the possible solution. Others suggest 951, 5040, 17,500, 1728, 10,000, etc.

ὁμοιούντων τε καὶ ἀνο-  
μοιούντων καὶ ἀνζόντων  
καὶ φθινόντων

of numbers unlike yet  
bearing the same ra-  
tio whether increas-  
ing or decreasing

[carried over from last page] 2460

(i. e. 1:2::4:8 or 8:4::2:1 It may also refer  
to the ascending and descending figures  
of the triangle. 8, 4, 2, 1, 3, 9, 27)

πάντα προσήγορα καὶ ῥητὰ  
πρὸς ἀλλήλα ἀπέφηναν

makes the sum com-  
mensurable and ex-  
pressible in all its  
parts.

sum = 2460

(i. e. 2460 is easily divisible by 1, 2, 3, 4, 5,  
6, 10, 12, etc.)

ὧν ἐπιτριτος πυθμὴν,

this sum increased by  
 $\frac{1}{3}$

$2460 \times 1\frac{1}{3} = 3280$

πεμπάδι συζυγείς

and adding 5

$3280 + 5 = 3285$

τρὶς αὐξηθεὶς

is multiplied by 3

$3285 \times 3 = 9855$

This solution of the problem, 9855, it will be noted, brings us again but by a different route to the magic number of our large square. The second part of the passage contains a description of the number by which the above calculation may be verified.

δύο ἁρμονίας παρέχεται

(the number) yields  
two harmonic parts,

τὴν μὲν ἴσην ἰσάκεις,

one of which is a  
square

$3 \times 3 = 9$

ἐκατὸν τοσαντάκεις,

multiplied by 100:

$9 \times 100 = 900$

τὴν δὲ ἰσομήκη μὲν,

the other has one side  
equal to the square

3

τῇ προμήκει δὲ,

and the other oblong

$3 \times 2985 = 8955$

sum = 9855

The remainder of the passage describes the length of the oblong which we have shown above to be 2985:

ἐκατὸν μὲν ἀριθμῶν ἀπὸ  
διαμέτρων πεμπάδος,

(the oblong) is 100  
times the side of a  
rectangle having di-  
agonals of 5.

$100 \times 3 = 300$

(i. e. having sides of 3 and 4.)

σητῶν δεομένων ἐνὸς ἐκάσ-  
των,

less of one each of the  
expressible parts, i. e.  
4 and 5

ἀρρήτων δὲ δύοιν,	and 2 of the inexpressible	$300 - (5 + 4 + 3 + 3) =$	285
ἑκατὸν δὲ κύβων τριάδος	plus 100 times the cube of 3	$(3)^3 \times 100 =$	2700
		sum =	2985

Plato states that the number of the State "represents a geometrical figure which has control over the good and evil of births. For when your guardians are ignorant of the right seasons and unite bride and bridegroom out of due time, the children will not be goodly and happy." The number 9855, expressing a period of 27 years, might thus represent the dividing line between the ages when men and women should begin to bear children to the State,—20-27 years for women, 27-34 years for men. (See also "Republic," Book V, § 460). Aristotle in his "Politics" (V, 12. 8) says in reference to the number of the State that when the progression of number is increased by  $\frac{1}{3}$  and 5 is added, 2 harmonies are produced giving a solid diagram. This, as may be seen from our analysis of the first part of the passage, may have reference to the number 3285, which, being represented by  $3^2 \times 365$ , may be said to have the dimensions of a solid.

In the January number of *The Monist* the Editor gave some very striking examples of the relationship between magic squares and the musical figures of Chladni. I would like to touch before concluding upon a closely related subject and show certain connections which exist between the magic square, which we have constructed, and the numbers of the Pythagorean harmonic scale. This scale had, however, more than a musical significance among the Greek philosophers; it was extended to comprehend the harmony of planetary movements and above all else to represent the manner in which the "soul of the universe" was composed. It is especially in the latter sense that Plato employs the scale in his "Timæus."

In a treatise by Timæus the Locrian upon the "Soul of the World and Nature," we find the following passage: "Now all these proportions are combined harmonically according to numbers, which proportions the demiurge has divided according to a scale scientifically, so that a person is not ignorant of what things and by what means the soul is combined; which the deity has not ranked after the substance of the body . . . , but he made it older by taking the first of unities which is 384. Now of these the first being assumed it is easy to reckon the double and triple; and all the terms, with



their complements and eights must amount to 114,695." (Translation by Burge.)

Plato's account of the combination of the soul is very similar to the above, though he seems to have selected 192,  $(384/2)$  for the first number. Plutarch in his commentary makes no mention of Timæus, but states that Crantor<sup>4</sup> was the first to select 384, for the reason that it represented the product of  $8^2 \times 6$ , and is the lowest number which can be taken for the increase by eighths without leaving fractions. Another very possible reason, which I have not seen mentioned, is that 384 is the harmonic ratio of  $27^2/2$  or 364.5, a number which expresses very closely the days of the year.

$$243:256::364.5:384.$$

The proportion  $243:256(3^5:4^4)$  was employed by the Pythagoreans to mark the ratio<sup>5</sup> which two unequal semitones of the harmonic scale bear to one another.

Batteux has calculated the 36 terms of the Pythagorean scale starting with 384 and his series must be considered correct, for it fulfils the conditions specified by Timæus,—the numbers all footing up 114,695: A few of the numbers of this harmonic scale marking the "first unity" and several of the semitones will be given.

1st octave	{	E	384	(For Batteux' full series and method of calculation the reader is referred to Burge's translation of Plato Vol. VI. p. 171).
		C	486	
		F	729	
2nd octave	{	C	972	
		F	1458	
3rd octave	{	C	1944	
		B-flat	2187	
4th octave		B-flat	4374	

By referring to our magic square it will be noted that the *first of unities*, 384, constitutes the magic number of the small  $3 \times 3$  square beginning with the number 100. If we arrange the magic numbers of the 81 squares ( $3 \times 3$ ) in the order of their magnitudes we find that they fall into 9 series of 9 numbers, each series beginning as follows:

I	II	III	IV	V	VI	VII	VIII	IX
87	330	573	816	1059	1302	1545	1788	2031

<sup>4</sup>Crantor lived nearly 100 years after Timæus the Locrian. The treatise upon the "Soul of the World and Nature," which bears the latter's name probably belongs to a much later period.

<sup>5</sup>for further references to this ratio see Plato's "Timæus," § 36, and Plutarch's "Procreation of the Soul," § 18.



The intervals between these series are worthy of note.

## INTERVALS.

Between I and II	243	the first member of the ratio 243:256.
" I " III	486	C of the 1st octave
" I " IV	729	F " " 1st "
" I " V	972	C " " 2nd "
" I " VII	1458	F " " 2nd "
" I " IX	1944	C " " 3rd "

If we arrange the magic numbers of the large squares ( $9 \times 9$ ) in the same way, it will be found that they fall into 3 series of 3 numbers, each series beginning

I	II	III
1017	3204	5391
Interval between I and II = 2187 B-flat of the 3rd octave.		
" " I " III = 4374	B-flat " " 4th "	

Numerous other instances might be given of the very intimate connection between magic squares and various Pythagorean numbers, but these must be left for the curious-minded to develop for themselves. Such connections as we have noted are no doubt in some respects purely accidental, being due to the *intrinsic harmony of numbers* and therefore not implying a knowledge by the ancients of magic squares as we now know them. The harmonic arrangement by the Greeks of numbers in geometrical forms both plane and solid may, however, be accepted, and Plato's descriptions of various numbers obscure and meaningless as they were to succeeding generations, may have been easily comprehended by his hearers when illustrated by a mathematical diagram or model.\*

Differences between the methods of notation in ancient and modern times have necessarily produced differences in the conception of numerical relations. The expression of numbers among the Greeks by letters of the alphabet was what led to the idea that every name must have a numerical attribute, but the connection of the letters of the name was in many cases lost, the number being regarded as a pure attribute of the object itself. A similar confusion of symbols arose in the representation of various concepts by geometrical forms, such as the five letters of YTEIA and the symboliza-

\* The description of the number of the State in the "Republic" and that of the Soul in the "Timæus" render such a mode of representation almost necessary. Plutarch ("Procreation of Soul," § 12) gives an illustration of an harmonic diagram  $5 \times 7$  containing 35 small squares "which comprehends in its subdivisions all the proportions of the first concords of music."

tion of health by the Pythagoreans under the form of the pentalfa or five-pointed star.

It was the great defect of the Greek schools that in their search for truth, methods of experimental research were not cultivated. Plato in his "Republic" (Book VII, § 530-531) ridicules the empiricists, who sought knowledge by studying the stars or by comparing the sounds of musical strings, and insists that no value is to be placed upon the testimony of the senses. "Let the heavens alone and train the intellect" is his constant advice.

If the examples set by Pythagoras in acoustics and by Archimedes in statics had been generally followed by the Greek philosophers, our knowledge of natural phenomena might have been advanced a thousand years. But as it happened there came to prevail but one idea intensified by both Plato and Aristotle, and handed down through the scholastics even to the present time, that knowledge was to be sought for only from within. Hence came the flood of idle speculations which characterized the later Pythagorean and Platonic schools and which eventually undermined the structure of ancient philosophy. But beneath the abstractions of these schools one can discover a strong undercurrent of truth. Many Pythagoreans understood by number that which is now termed natural law. Such undoubtedly was the meaning of Philolaus when he wrote "Number is the bond of the eternal continuance of things," a sentiment which the modern physicist could not express more fittingly.

As the first study of importance for the youth of his "Republic" Plato selected the science of numbers; he chose as the second geometry and as the third astronomy, but the point which he emphasized above all was that these and all other sciences should be studied in their "mutual relationships that we may learn the nature of the bond which unites them." "For only then," he states, "will a pursuit of them have a value for our object, and the labor, which might otherwise prove fruitless, be well bestowed." Noble utterance! and how much greater need of this at the present day with our complexity of sciences and tendency towards narrow specialization.

In the spirit of the great master whom we have just quoted we may compare the physical universe to an immense magic square. Isolated investigators in different areas have discovered here and there a few seemingly restricted laws, and paying no regard to the territory beyond their confines, are as yet oblivious of the great pervading and unifying Bond which connects the scattered parts

and binds them into one harmonious system. Omar, the astronomer-poet, may have had such a thought in mind, when he wrote:

"Yes; and a single Alif were the clue—  
Could you but find it—to the treasure-house  
And peradventure to the Master too;

Whose secret presence, through creation's veins  
Running quicksilverlike eludes your pains;" etc.

When Plato's advice is followed and the "mutual relationships between our sciences" are understood we may perchance find this clue, and having found it be surprised to discover as great a simplicity underlying the whole fabric of natural phenomena as exists in the construction of a magic square.

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## THOUGHTS ON TIME, SPACE, AND EXISTENCE.\*

### I.

All existence is one. Every thing that is, is part of the All. That all of the parts are adjusted to each other, and work in harmony, proves the relationship of all the parts to the whole, and the unity of the All.

Existence extends, and existence endures. While it endures there is an unending and unceasing succession of events occurring.

When we mentally think away all of the features of existence except the feature of extension, that feature which remains when all the rest are thought away, forms, in consciousness, the conception we term space. Space, then, is abstracted mentally from reality, and in so far is a mental existence. But in reality itself, space, or the property of extension can not be separated from existence. We think of it as a thing in itself, or by itself, but this is not the

\* A great many of the ideas expressed in this article have been obtained by a study of the philosophical works of Dr. Paul Carus, and I wish to give proper credit for numerous expressions and quotations which I can not well avoid using. Prior to my study of his writings, my philosophical studies had been confined mostly to the works of Herbert Spencer. While I had in a certain degree noticed that he overlooked the importance of the formal and the subjective features of existence, my ideas along these lines were very hazy and undeveloped. I supposed, that in his philosophy, finality had indeed been reached. However, when I began to study the works of Dr. Carus, a new world was opened to my view.

case. It is merely the property of extension belonging to actual existence, mentally separated, or abstracted from the All.

Duration, of itself, does not exist in reality. It is the property of existence, by which the All endures. When we mentally abstract or separate from existence the feature of duration, and think away every other feature of existence, that which remains, forms, in consciousness, the conception we term time. Time, however, does not exist, and can not exist as separated from existence. It is not an entity of, or by itself. It is abstracted from that feature of existence which events occupy, and bears the same relation to events that space does to the material element of existence. By material element I do not here mean ponderable matter only, but the ether as well.

Events, however, are always a motion of some kind; therefore, time bears the same relation to motion that space does to matter. Time, to consciousness, seems to be that which events fill; space, that which matter fills. Time is the blank form which events fill, with the events mentally removed. Space is the blank form which matter fills, with the matter mentally removed. In so far, time and space are mental forms, or forms of thought.

Time, then, is an abstract from motion; and space is an abstract from matter. But motion and matter do not exist in nature as separated from each other, or from the rest of existence. There is no motion except as something moved, and this something we call matter. There likewise is nothing moved without there is motion. Neither does any matter exist that is not in motion. There is thus no motion without matter, no matter without motion.

The abstracts, time and space, must then be intimately connected, as they are both abstracted from these two intimately connected features—or, rather, abstracts of existence; for we can truly say matter and motion are both abstracts from one reality.

Let time be represented in consciousness by a straight line. It must be remembered, however, that this line is a symbol, and is not actual time itself. However, in dealing with time, it seems necessary for the sake of simplicity, to use a mental symbol to represent it; owing to the difficulty of dealing with actual time itself, and of representing time in consciousness as it actually is.

Time has extension in one direction only. This is also true of a straight line. We can therefore say each has dimension in one direction; each is a system of first degree. The line representing time may be represented as in motion, passing continuously in the

direction of its length. It must also be represented as moving with a uniform and steady motion.

Time being abstracted from motion, can be measured and in fact is measured, by motion of some kind. Dr. Carus says, "Time is merely the measure of motion." We can also say motion is the measure of time. The simple means of a swinging pendulum is one example. If we represent this motion by a point moving or oscillating in space in a straight path, each portion of time will be represented by a straight line. Now, as each portion of time can thus be represented by a straight line of finite length, all of time can be represented by a straight line of infinite length. This line is, however, formed one portion at a time, in regular succession: therefore, we must either imagine ourselves in motion, traveling along such line; or else imagine ourselves at rest, and the line in motion in one direction continuously. Now, by mentally reversing the direction of the motion of the line, or our motion in traveling along such line, we can mentally bring all portions of it that have already passed, into the field of our consciousness.

But motion means not only something moved, but it means change of position. Now position is determined by matter, an abstract of actual existence; so that any line used in representing time, must bear a distinct relation to matter. It must possess dimensions, although but in one direction.

Time can best be represented in our consciousness by such a line; and as this line bears distinct relations to actual time, the conclusions reached by representing time by such a line, should be true in regard to actual time.

Space is of infinite directions. Time is of but one direction. To determine position in space, three coördinates are necessary. Space is then a system of third degree. To determine location in time, but one is necessary. This one is the present. Time is then a system of first degree. Time being represented by a straight line, some particular point in this line marks the present.

This line being represented in motion, moving continuously in one direction, those portions of the line which have at some time been marked by the point called the present, we designate the past. Those portions of the line which will sometime be marked by the point called the present, we designate the future. There is a difference in the past and future; this difference is a difference of succession. In this line no part can be substituted for any other part. In other words, this line is not homogeneous. Any por-

tion of the line which first passes the present, we will designate as "before"; and that which succeeds it, we will designate "after." The difference between before and after, is an actual difference in nature, and not a difference due to the nature of thought. It is a difference of relation; but relations between things are just as real as material things themselves. It is therefore not a difference within our own minds. This can be verified easily by reversing some simple process; so that the first part of such process be postponed until after the last part be executed. The impossibility of such a proceeding is at once apparent. For example, iron must be heated before, and not after it is welded; it must be melted before, and not after it is cast; a hole must be drilled before, not after a pin can be passed through it; etc. This difference then is only relational, but it is actual and real.

As all time must be filled by events, all time that has passed has been filled by events, or occurrences. If there could have been a beginning of events, then there must have been a beginning of time. Events, however, being always a motion of some kind, a beginning of time or events would be a beginning of motion.\* But motion and matter being both abstracts of one reality, if there was a beginning to motion, there must have been a beginning to matter also; and consequently a beginning to space. Space and time are intimately related to each other: for instance, "Space is the possibility of motion"; "Time is the measure of motion." They are both thus intimately connected with motion; but motion can exist only as something moved; therefore, they are both intimately related to matter, to that feature of existence of which dimensions or space is a property. In fact no feature of existence can have had a beginning, unless all of existence had a beginning. The features of existence are so intimately related and connected, so work hand in hand as it were, that they are in fact a unity; so that what has been true of any one feature in this respect, must have been true of all; and all features of existence must partake of the same destiny. Annihilation for any one feature of existence, must mean annihilation for all.

If there was no beginning to time, and if there can be no end

\* Causation has been shown by Dr. Carus to be always a motion. (See chapter on "The Problem of Causality," *Fundamental Problems*, page 79.) Therefore if motion or time had a beginning, causation also had a beginning. The first motion was the First Cause, and all others followed. Behind this must lie a reason for the first motion or the first cause.

to time, then it is truly infinite, and without end in either direction from the present.

If this be true, and the world stands at the point of the line called the present, then there is an infinite past in one direction, and an infinite future in the other; two infinities of the same thing, each without end or limit, yet they do not interfere with each other. Neither in any way limits the other, so as to prevent its being infinite. The thought has occurred that possibly the distant future overlaps the distant past, as it were, in some manner; and that the future and the past are one in some way. This can be imagined only by thinking them as being something like a circle. However, the actual and real difference between before and after makes this impossible.

Although both past and future are of infinite duration, and neither limits the other in any manner that prevents its being infinite; yet if we look at this question from another standpoint, the future limits the past at the point called the present, and vice versa. The present is a finite terminus of both; it is a limit beyond which neither can pass without passing into the other. If we mentally remove this terminus, then both future and past are one infinity.

However, if time as a whole is infinite, both future and past are infinite. If we halve infinity, infinity still remains. It can also be said that if we divide infinity by one hundred, or by one million, or by any number no matter how great, the quotient obtained will still be infinity. This means, practically, that no matter into how many parts any infinite feature of existence be divided, each part will still be infinite; or, in other words, as great as the whole was before it was divided. This means, also, that the sum of any number of infinities would be only infinity. The parts are individually as great as the whole, and the whole is no greater than any of its parts. Then nothing is gained, or no increase made, by adding one infinity to another. Neither is any decrease made by any division of infinity or subtraction from it. Then, no matter to what extent the division into parts be carried, we never can arrive at a finite part. If this be true and infinity can not be divided into finite parts, how can finite parts however great their number, make up infinity? No addition of finite parts can make infinity; for infinity is not a number, correctly speaking; it is something else. We must say, with Dr. Carus, that infinity is not an accomplished process; neither is it a thing, an objective something; but merely a process that never can be finished, just as the fraction  $\frac{1}{3}$  can never be expressed



as a decimal. "It is a process that from its nature is incapable of being finished."\*

Then, to divide infinity into finite parts, we would have to divide it into more parts than any number; which could only be an infinite number of parts. We should have to divide infinity by infinity; but as this is a process that can never be finished, we can not mentally make such a division. However, it would seem that nature has actually made such a division of the infinite past into finite parts; that nature in this case has actually accomplished, or finished an infinite process. For if the portion of time antedating the present is infinite, it has certainly been accomplished. Each finite event that has made up or filled past time, must have existed finitely when it occurred.

Now here occurs one great difficulty. If past time has been infinite, how did events ever arrive at the present? To have done so infinite time must have actually passed. The present is a terminus,—a finite end; and if we reverse the process and mentally move backward from the present towards the remote past, it should be possible to arrive, mentally, at each event that has filled or made up time throughout this infinite past. Now, as each succeeding event at which we arrive must have preceded the one just passed, it is evident that all portions of past time, whether time be infinite or not, must have been present at some stage of existence. The events which make up all portions of past time must have actually occurred, must have been real, and must have existed finitely, and one at a time. It seems evident to me that if by moving in this direction, no limit can ever be reached; and if we can never arrive at a point where these events began, when in reality time was moving in the direction it really is, or in other words was accomplishing the past, the limit called the present never could have been reached. If nature could accomplish or complete this process, moving in one direction, we ought to be able to complete the process of mentally journeying over it, in the reverse direction. In other words, past time is just as long whichever way we mentally journey over it. If no limit can be reached by moving in one direction, then it seems no limit could be reached by nature itself moving in the other direction. If, no matter how far backward along this line we mentally journey, we never can arrive at a point where time began or commenced,—if, in other words, it never commenced; then how, in reality can anything, or rather, any feature of existence, finish

\* *Fundamental Problems*, Pages 159, 161, and 169.



a journey it never started or commenced? More correctly speaking, how could time or events finish a process which never was commenced? But, however, as a limit has been reached in one direction, it suggests the idea, at least, that a limit might be reached in the other. In fact, it seems that the present, or rather the point of time marked by the present, could have been arrived at, only by events that make up time having a beginning. Can it be that existence, as we know it, is not eternal?

Of course, if we do move along the line, backwards, towards the past; no matter how far we continue the mental process, when we mentally reverse the motion, we can return to the point of starting, which is the present. A mental process which we can accomplish in one direction, we can of course accomplish in the reverse direction. But if time is infinite, no matter how far from the present we had mentally moved, and no matter how far from the present the point reached was located, yet infinite extension lay beyond that point. The extension still lying beyond that point was just as great as it was before we had mentally moved to that point. We had reduced the distance none. And no matter how far this process had been continued no terminus could have been reached. Now if time is infinite, we never can reach mentally, such a terminus; because it is an unending distance. There is no such terminus to reach. How could nature have accomplished or completed a process, in moving in one direction, which it never could complete, if moving in the reverse direction? How can nature have actually passed over an unending distance, or rather, have completed an unending process?

If nature could reverse its direction, and move backward over past time, the journey should be just the same as nature is to make in moving over future time. If a terminus could be reached in the one case, a terminus probably can be reached in the other. But if nature could not reach such a terminus moving backward, I can not see how, in reality, it ever accomplished the process moving in the reverse direction as it did, and arriving at the present. This would seem to indicate that the process of the past definitely commenced or had a beginning.

The future may be regarded as a process in which there is the possibility of unlimited duration. But the past is a process that has been accomplished. It is definite and has occurred. It is a fact and has been actual. No portion of it is a mere possibility, but all portions of it have actually been realized. No matter how remote

any event that made up past time may be, yet it was just as certainly accomplished as any more recent event. Were this not true, and had time halted and not completed any event in the chain of the past, the present would not be here. The mere remoteness then of any event whatever, in no way detracts from its reality, or its actual existence.

Reckoning from the present, whatever the distance may be down the line of the past, whether infinite or finite, the process of the past up to the point marked by the present is certainly an accomplished process. Now as infinity means, simply, a process that never can be completed, then it would seem that the past can not be infinite. We have, then, in dividing the past from the future, divided time into two parts, one of which seems not to be infinite. Now, if infinity can not be divided into finite parts, by dividing it by a finite number, would not the above result indicate that time as a whole is possibly not infinite?

There can be no time without motion, and no motion without matter as before shown. Now if matter had a beginning, time also must have commenced with matter and motion.

As a fact, it seems there is little doubt that ponderable matter had a beginning. The ether may not have had, as it seems to exist without form; but the ultimate particles of the elements have form, and are evidently what they are simply on account of the form they possess. Now every thing that has form must have been formed, by some formative factor. This would mean that the atoms of the elements were formed,—had a beginning.

Let us take the atoms of any one element. They are so absolutely alike that any one could be substituted for any other, and there would be no change. This substitution, so far as we know, could in no way be detected. The number of the atoms of any one element in the universe may be regarded as being so vast that to our minds it would seem infinite. Yet all this vast number of atoms are absolute duplicates of each other.

If all these atoms never had been formed but had existed always without a beginning, what are the mathematical chances of any two of them being alike, to say nothing of all of them being alike? As practically an infinite number of forms could exist, each atom would have one chance of existing in each one of an infinite number of forms. This means that each atom would only have one chance in infinity of existing in any one particular form. There would thus be only one chance in infinity for any two atoms to be

formed exactly alike, much less the almost infinite number of each element that are absolutely alike.

This likeness between the atoms can not be by chance or accident; it can be only by there being a reason for it. This reason must be that the same formative factors produced all the atoms of the same element. Likeness means relation; and relation in this use of the word, means a common origin or parentage, as it were.

If the new electronic theory of matter be correct, then the probabilities are that each atom consists of a group of electrons, held together in a certain form; that the electron with its surrounding field of force, is the primordial unit of matter from which the elements were formed. But if this be true—and we have here penetrated to the region where it seems force and matter are one—yet each electron is of absolutely the same form as are all the other electrons that make up force, or rather, energy, and matter. The likeness of all in their case can be explained only on the ground that they were formed; that they had a beginning.

Any concrete thing, or any portion of existence possessing form, must have had a beginning; and it must also pass away. The existence by which any concrete thing is actualized is permanent, but the formal feature is subject to the law of eternal change. It is the formal feature of things that appears and disappears. The appearing of form is always caused; and when any number of things have the same form, they have originated from the same cause. All things possessing form must have originated. They must have commenced, as such concrete things, at a definite time.

Should force and matter be derived in some way from the formless ether, by its taking on or assuming form, or by form being impressed upon it in some way, I think this would not necessarily mean a beginning to time. The ether is able to transmit motion and, it would seem, bears some relation to motion. It must therefore bear some relation to time.

Time is abstracted from motion, but time and motion are not identical. It is true that there can be no motion without time, and no time without motion, as we know them. There is a relation between these features of existence but they can not be identical. The momentum of a moving body varies directly as the weight or mass of the body moving; but it also varies as the square of the velocity. This would indicate that velocity is the greatest factor in the momentum of a moving body. But velocity is made up of two elements, the time element and the space element. The time

element of motion is thus shown to be very real; and is as independent of motion, as motion is of time. Yet the relation between the two is so intimate that the non-existence of one means the non-existence of the other.

Either time had a beginning, or it had not. No third possibility can be imagined. Time is merely one feature of the All-existence. To say that time had a beginning or that it had not, simply means that events had a beginning or that they had not. Either events did commence, or there has already passed an unending chain of them.

To say that events had a beginning, is making a statement utterly beyond the power of the mind to realize in consciousness. The first thought that occurs when making such a statement, is that there was a time when events commenced. This supposes time already existing when events began, which is an absurdity; as there can be no time where events are not.

It is also beyond the power of consciousness to realize the statement that events are part of an infinite series, that never commenced, but always was; for each event was a transitory occurrence. None of them could be permanent, therefore, any series of them would seem to possess this transitory character. Such series would seem not to be permanent, or rather eternal. Each finite event that makes up the series of the past, must have existed, must have been real, and must have required duration to exist. Each by itself must have commenced, endured, and terminated. Then if *all* the events of this series commenced, did not the series also commence? If there can be *no* event of this series that did not commence, how can we escape the idea that the series commenced? Evidently we can only escape this idea, by imagining more events in this series than the word *all* can express.

However, no matter what the difficulties are, the present is here. Now, in fact, all portions of past time were the present as they passed; and the present has not been reached, but was always here and moved along with time. Dr. Carus, quoting from Schopenhauer, says, that there are not three times, past, present, and future: there is but one time, which is the present, and it is always. This is true from the point of view where the whole of eternity is viewed as one. However, events occur in a succession. Certain events precede others. There is a difference in nature between before and after. This difference is actual and has an objective existence. Were this not so, as before shown, processes could be reversed.

When we speak of past time, we mean the feature of duration abstracted from events that have actually occurred. By the future, we mean the feature of duration abstracted from events that are to occur. Events that are to occur are just as real, just as actual a part of existence, as events are that have already occurred.

When we speak of the present, we ordinarily mean that portion of duration in which events are in process of occurring. However, if we analyze our conception of the present for a moment, we must conclude that the present has no duration; it is not a portion of time correctly speaking. If it were a portion of time, we should be able to determine how long a period of time constitutes the present; whether a minute, a second or a fraction of a second. We should have to place a limit somewhere, which would be wholly arbitrary; and if we gave it any finite length or duration, certain portions of it would be already passed, and certain portions of it would lie in the future.

As the present has been always, we must represent it as moving along over all portions of time; as a point without dimensions, marking position or location only.

Then that which we call the present, can in reality have no more dimensions than a geometrical point has; and if we say that the present has no dimensions, which means that it has no duration, it is not, properly speaking, a portion of time. Time has duration; and any portion of time must have some duration. If the present has no duration, merely marks position as it were, it merely divides the past from the future; it divides the events that have occurred from the events that are to occur. Each event, as it occurs, passes from the portion of the imaginary line where are the events that are to occur, to the portion of the line where are the events that have occurred. A line has dimensions in one direction only; time has duration in one direction only. A point merely marks position in a line; the present merely marks the dividing position between the past and the future.

Whether time had a beginning, or whether it had not, we can not decide positively; but we can decide that which seems to our minds most probable. I have sometimes been inclined to the belief that events as we know them had a beginning. That existence, as known to us, with its features of time, space, matter, energy, spirit or subjectivity, the formal and the relational, had a beginning. That it possibly originated from a form of existence utterly unknown to us; a form of existence where the word "form" hardly applies,

as there could have been no formal then ; an existence where matter, energy, time, space, and all features of existence as we know them are not. An existence where the word "existence" must be used for want of a better word, but that which is meant is something other than existence as we know it.

If existence had a beginning, we must think of it in this manner ; for we can not imagine that it could arise from nothing. Of course, if a beginning did occur, an end can also come to existence as we know it. Then time and space will cease to be, and so will all things that are actual and real.

However, in spite of the difficulties herein mentioned, it seems to me, most probable that time is truly infinite or eternal, and did not have a beginning ; that if it did have a beginning which means that existence had a beginning also, in order to comprehend this statement we should have to be able to mentally annihilate all existence, which would include our faculty of reason ; and we could therefore in no way reach such a conclusion.

## II.

As before stated, space is abstracted from the material element of existence. We mentally think away all of the qualities of existence, except that of extension. That which is left we term space. It does not exist in reality separate from other existence. It is merely that property of existence by which it extends. Space is filled with existence as we know it. Matter together with the ether fills all space. We can find no space empty of both.

Space then seems to contain all existence, material or otherwise ; including time or duration, events, as well as the formal and the relational, together with all the laws of existence. But, as Dr. Carus says, we must not think of space as an empty box containing existence, as a thing-in-itself. It is merely the property of extension which existence possesses. He also says it is the possibility of unlimited motion in all directions.

If time is merely the measure of motion, space must likewise be the measure of matter ; and as space is a mental abstract from the material feature of existence, there can be no space, except as there is existence filling it. Space means dimensions. There can be no dimensions, except dimensions of something—of actual existence. A nothing could have no dimensions, neither could it have any other attributes, features, or qualities. It therefore could not exist, or if it could it in no way could be known to us. In fact, if it existed, it

would be a something. There can be no region outside of space, no border line beyond which lies nothing. Nothing could in no way bound space, or existence. To do so, dimensions would be required. As a nothing can have no dimensions, space—or, more correctly speaking, existence,—can not be bounded by a nothing.

Most words have meanings because they represent an objective reality. The word "nothing" stands for no objective reality or existence. It is a word to express the non-existence of things that are. Now the non-existence of any thing that is, is an impossibility, an absurdity.

When we speak of nothing, we ordinarily mean space with all matter extracted or removed therefrom. Now this is an impossibility; but were it possible to entirely remove ponderable matter from such a vacuum, the ether would still remain. Also, were it possible to produce a vacuum in which there was neither matter nor the ether, we should still have space or dimensions remaining; neither could we remove from such a vacuum, time, the laws of mathematics, the action of gravitation, or any of nature's laws. All of these are parts of existence, and are as actual and as real as are the other features of existence. They are not material, it is true, but they are just as real as matter. Time and space are something and not nothing. If time and space were nothing, we should, as Spencer says, have two different kinds of nothing, which is an absurdity. The ether also is as much an actual existence, as is that feature of existence which possesses mass, gravitation and inertia, and that can be affected by friction.

It may be regarded as proved that the ether exists everywhere; not only in the spaces between the stars, but also penetrating the actual atoms of matter. That is, the ether and material atoms actually occupy the same space at the same time. It is as if the ether were something like a condition, rather than like an actual material as comprehended by our consciousness. Matter can move through the ether and meet with no resistance; because there is no contest for space or position, as it were, between ether and gravitational matter, both being able to occupy the same space at the same time.

Now the ether is everywhere; and as before stated, it can by no possible means be removed from any portion of space, any more than time, dimensions, or the action of gravitation can be removed from space. No vacuum can be made void of the ether; but if such a thing were possible, we should not have a true nothing, for space is something. A true nothing must be void of space as well as of



the ether, and therefore can not have dimensions; for if it did have dimensions it would be a something. If we could remove the ether from a portion of space, so as to form a void, this void would be bounded by walls of ether; but if this void were nothing, having no dimensions, the walls of the ether would still be in contact, which is an absurdity. It is plain that dimensions, being an attribute of or abstract from that which actually exists, can not therefore be possessed by nothing; and as nothing can not have dimensions or any other feature of existence, it must be a non-existence, a creature of the fancy, an absurdity, an imaginary annihilation of that which is.

Further, if a nothing can possess no dimensions, it can in no way limit actual existence. An infinite number of nothings, if they existed in the ether everywhere, could not make themselves known; and requiring no room, the ether would not be displaced, but would contact itself at all points. Neither could a nothing in any other way be known or detected by any form of existence, as it could possess no qualities, attributes or features.

As before stated, there can thus be no region out in space beyond the cosmos, where there is nothing; for a nothing having no dimensions can not bound a cosmos having dimensions. It could in no way limit existence or in any way displace anything that is. If the cosmos is infinite, having no limits it can not be limited by a nothing; while if it were finite, it would possess finite dimensions, and could not be bounded or limited by a nothing having no dimensions. Therefore everywhere there is something. That is, the All is infinite and without end in space, and would seem to be eternal, or without end in time. In fact, both time and space are parts of the All, or different modes of manifestation of the All to our senses.

Then, there can be no end to space, or more correctly speaking to existence, in any of the infinite directions of space. If we could travel in any direction, at any speed however great, no matter how long we might continue such a journey, we should never arrive at a limit or boundary. It would then seem that non-existence is an impossibility. Existence is positive, is actual, and in no way can it change into non-existence. Such a change would be an absurdity. We came out of the All at birth, and return into it at death. The All is infinite in both space and time, and possibly, "in diversity in the same space at the same time."

Things that are, neither came out of nothing nor can they return into nothing. Every thing that is, was built or formed out of what previously existed; this means spirit as well as matter, soul as well



as body. The fact of the existence of a thing proves at least the permanence of that of which it is formed or constructed; and thus are we ever more firmly convinced of the permanence of that which is.

## III.

Why this mystery? How came it so? The world-old problems are still with us. How came we here? Why do we exist? What is our destiny?

We awaken into existence to find ourselves on a monster globe rushing through space at inconceivable speed, in a well-defined path or orbit. We also learn that the world and its orbit, together with all the sister planets and the parent sun, are falling into the unknown depths at a terrific velocity; that this fall has been going on since the world began. We are descending towards a point near the giant sun, Vega. Our actual path is a huge spiral.

Never, since the world began, has there been one moment of quiet or rest; but we have been continually falling into the "deep that is infinite," into the "ocean that is without bottom and without shore." While we continue this terrific journey into the unknown abyss, the mighty River of Time is rushing along, bearing us, the world and all we know, like ephemeral creatures on the crest of a wave called the present, to a destiny no man can foresee. Yet, all things seem to have a purpose in fulfilling their destiny. Let us hope that our existence, also, is not without a purpose.

The old questions, How came this mystery? How came we here? Why do we exist? What is our destiny? must ever press for solution as long as man has a mind to think with, and a desire to live. As long as man shudders at the thought of annihilation of self, will he struggle to solve these problems.

Science, in attempting to answer the question, How came we here together with this world? has become involved in innumerable controversies with religion. Yet the difference between them, if viewed impartially, is only a difference of detail. They are both agreed that we and the world were not always here. Consequently, we must have appeared out of the void at some definite time. That we did not come by any power of our own, both are agreed. Therefore, we were produced by a power other than ourselves. That same power will take us away again, and that power holds our destiny in the hollow of its hand.

Whether that power is, as religion has taught, a concrete personal being, that has fashioned this world, our bodies and our souls

*When you understand the law of your own being, you will understand the law of the universe. Know thyself! —*

as well, outside of itself, as separate existences from itself; or whether, as science is teaching, that power is not a concrete being but is a power immanent within all concrete things and beings, is uncreate and uncreatable, is without form but perfectly real; yet, we must all admit that this power, whatever it is, was perfectly capable of producing us and the world.

The method pursued makes little difference to us; the results are the same. We are here. This power has created us. What our destiny is to be, human eyes can not yet see. We can only hope. Science gives us a faith. We were not made of nothing. "That which is now us, was before, and will be after us." "The All-existence will not lose an iota at our death."

Positive existence can not be changed into nothing. It must be changed into something else. The change is merely transformation. Our beginning was transformation, so will be our end. Death then is transformation. This means, for both body and soul.

"There is one reality. Viewed from different standpoints it presents different aspects to us." "Viewed from the outside, the aspect is material. It is matter in motion." From the outside our beings have this aspect: "They appear as an object in the objective world, moving about." But, viewed from the other side, from the inside, the aspect is that of spirit. Here we find only thought and feeling. Joseph Le Conte says, when we look within ourselves, we experience by introspection, only thought and feeling. That this is the only place in nature where we do get behind matter, and here we find only spirit.

These are the two sides of reality, but, as Dr. Carus says, we must remember that they are both merely aspects of one reality viewed from different standpoints. X "The spiritual side of man, that is the subjective side, his thinking and feeling, his innerness, is just as real as is his material, or objective side." Both belong to one reality; they arise together and go hand in hand. At death they partake of the same destiny. Neither can be destroyed; only transformation can take place.

The formal element of all existence is subject to continual change. No form or structure can be permanent. It is the structure of ourselves that is changed in death. Death is a transformation of the formal element of existence. Existence of itself is permanent, but its formal element is in a constant flux. Its structures are continually modified and changed. Thus it is that all compounds will be dissolved again. All things that can be changed, will be

*X But <sup>it</sup> is only on the spiritual side that we see the creative power that upholds us, and by this knowledge are able to avoid destruction.*

changed some time. No concrete thing can be permanent. No structure can endure.

If forms were permanent, no change could ever take place. There could be no motion. There would be no causes, and no effects. Existence would be one vast tomb, where never an event could occur, and where monotony would be so terrible, that immortality would be a curse. In an existence where form is one of its features, it is well that such existence should be a perpetual motion within itself, and that the law of eternal change should prevail.

We must not forget that all structures have their subjective side. Our souls are the subjective side or innerness of special structures, of special forms of existence passing through a series of changes of a special form. The existence out of which both the subjective and objective sides of these special structures are formed, or created, is permanent. All existence has its subjectivity, or innerness within itself. When water is brought into contact with calcium carbide, and the love of the hydrogen atoms is felt for the atoms of carbon, and they rush together and unite, forming a new compound; I believe there is a subjectivity, or innerness within these atoms which directs their action. This subjective side of nature which corresponds to the spiritual in man, is just as real, and just as permanent, as is the objective side, the outside, or material side of existence. Both sides are but different views of one reality, as Dr. Carus has so ably demonstrated.

"Whither do we fare?" The great River of Time will some day bear us to a region where the answer awaits us. But we can rest assured, we are not borne toward that hideous monster, annihilation. Rather let us hope that the transformations which are to come, will not be as a sleep deep and profound, but "as a dream filled with pleasant visions." Yes let us hope; although out of the stillness of the depths no voice ever comes, and our riddle remains unsolved.

"The heavens are our riddle; and the sea,  
Forested earth, the grassy rustling plain,  
Snows, rains and thunders. Yea, and even we  
Before ourselves stand ominous in vain!  
The stars still march their way, the sea still rolls,  
The forests wave, the plain drinks in the sun,  
And we stand silent, naked—with tremulous souls—  
Before our unsolved selves—we pray to one  
Whose hand should help us. But we hear no voice;  
Skies clear and darken; the days pale and pass,

Nor any bids us weep or bids rejoice.  
Only the wind sobs in the shriveling grass—  
Only the wind—and we with upward eyes  
Expectant of the silence of the skies."—*Herbert Bates.*

DAVID P. ABBOTT.

OMAHA, NEB.

### ESPERANTO.

Esperanto, a universal language invented by Dr. Zamenhof, a Russian, and advocated mainly in France, has at present outdone Volapük, and enjoys a great popularity among the circles of those who favor the adoption of an auxiliary international language. We had some correspondence on the subject with Monsieur Couturat, and have discussed the problem in former numbers of *The Monist*. Though we do not say that it is impossible to construct an artificial language which would be simpler than any of the natural languages, we believe that it would be easier for mankind to adopt the simplest natural language, and accept it as the international medium. It seems to us that among all the languages of the world, English possesses the greatest chance of becoming a medium of international speech. In fact it is the only language which possesses an international character. English is spoken not only in Europe, but in Canada, United States, Australia, South Africa, and constitutes the natural medium among the different races of India, among the Europeans in China and almost any other country of the globe.

We are not blind to the objections that can be made to the adoption of English as an international language, but we believe that English can most easily be changed into a shortened English, a language built after the pattern of the English, utilizing its simplest constituents, endings, grammar and syntax, and avoiding the difficulties of spelling.

The objections made by the advocates of a purely artificial auxiliary international language are mainly directed against the English nation, claiming that it would be materially benefited by forcing its speech upon other countries. Further there is the *th* which is difficult for the continental European to pronounce; and a few other inconveniences in pronunciation exist, none of which are too strong to be overcome. Whether or not the English will conquer in the long run, or whether Esperanto will gain the victory remains to be

seen. For the benefit of our readers we will here present an impartial exposition of the nature of the language, its endings and prefixes, and its general construction.

#### LETTERS AND THEIR FORMATION.

Esperanto is built mainly upon the Latin grammar, and its constituents belong pre-eminently to the Romance languages, with a few scattered ingredients from German and English. The vowels are pronounced in the continental way; "a" as in father, "e" as "a" in care, "i" as "ee" in seen, "o" as in quote, "u" as in rule. The diphthong "au" is pronounced as "ow" in cow. Most of the consonants are pronounced the same as in English, especially "b, d, g, k, l, m, n, p, r, s, t, v, and z," but "c" is pronounced like the German "z," i. e., like "ts" in the Russian word Tsar, and "j" is pronounced like "y" in yes. Further there are a few consonants which are differentiated by a double accent (circumflex). This combination will make Esperanto objectionable in many printing establishments because the characters are not now made in our type foundries, and we will here replace the accented letters by italics. This differentiated "c" is pronounced as "ch" in church; the differentiated "g" is pronounced as "g" in gin; the differentiated "j" as the French "j" or as the English "s" in pleasure; the differentiated "s" as "sh" in shall.

We see that Esperanto has also its difficulties in pronunciation as well as Volapük. Ts, the Esperanto "c," is hard to pronounce, and there are many Germans who find difficulty in pronouncing the soft "g" in such words as "German," being unable to distinguish it from *Cherman*. The same is true of the French "j" corresponding to the English sibilant in pleasure.

#### NOUNS, ADJECTIVES AND ADVERBS.

The ending "o" indicates a noun; the ending "a," an adjective; and "e," an adverb. Thus "patro" is father, "patra" is paternal, and "patre" is paternally. The plural is formed by adding "j," and the objective case, by "n." Thus "patroj" means fathers. "patron" is father in the objective case, and "patrojn," fathers in the objective case.

#### PRONOUNS.

The pronouns are as follows: "mi," I; "ci," thou; "li," he; "si," she; "gi," it; "ni," we; "vi," you; "ili," they; "si," the reflexive of the third person, himself, herself, or itself, oneself, themselves; "oni"

corresponds to the French *on* or the German *man*. The objective case of the personal pronouns is formed as in nouns by adding "n" to the subjective form, as "min," me, while the possessive is indicated by the adjective ending "a": "mia," mine; "via," yours, etc. and "illiajn patrojn" is an acusative plural meaning their fathers.

#### NUMERALS.

The cardinal numbers change their forms as little as in other languages. They are:

1 unu	5 kvin	9 nau
2 du	6 ses	10 dek
3 tri	7 sep	100 cent
4 kvar	8 ok	1000 mil

They are combined as in English, for instance 735 is "sepcent tridek kvin."

Ordinals are formed by adding the adjective ending "a": "una," first; "dua," second; "tria," third.

Multiples are formed by the ending "obl"; twofold is "duobla" and tenfold, "dekobla"; fractions by adding the ending "on": one-half is "duono" ("du," root; "on," fraction ending; "o," noun ending) three-fourths is "tri kvaronoj."

By adding "op" before the adverbial ending "e," collective numbers are formed which are introduced in English by the preposition by; for instance, by dozens is expressed as "dekduope" in Esperanto. When he wishes to say "at the rate of" the Esperantist uses the preposition "po," thus "po ses" means, at the rate of six.

Ordinal adverbs, as, firstly, secondly, and thirdly, are formed by adding the adverbial ending "e" to the corresponding cardinal numeral; thus "unue, due, trie," etc.

#### VERBS.

The endings needed for the verb are much more numerous than in English. The ending "as" stands for the present, "is" the past, and "os" the future. The imperative is expressed by the addition of "u" to the root; the conditional, by "us"; the infinitive, by "i"; thus: "mi skribas" means I write; "mi skribis," I wrote, "mi skribos," I shall write; "skribu," write; "ni skribu," let us write; "mi skribus," I should write; and "skribi," to write.

The participles follow the same rule, viz., that "a" stands for the present, "i" for the past, and "o" for the future. The endings "ant," "int" and "ont" are the active participles and "at," "it" and

"ot" are the passive participles. Thus "skribanta" means writing, "skribinta," having written, and "skribata" being written.

## PREFIXES.

The language is further enriched by a number of prefixes and suffixes. The prefixes are as follows:

"mal-" denotes opposite ideas; "rica," rich; "malrica," poor; "fermi," to shut; "malfermi," to open.

"bo-" denotes relation by marriage: "patro," father; "bopatro," father-in-law; "frato," brother; "bofrato," brother-in-law.

"ge-" denotes persons of both sexes, taken together: "mastro," master; "gemastroj," master and mistress; "onklo," uncle; "geonkloj," uncle and aunt.

"dis-" denotes separation (as in English): "jeti," to throw; "disjeti," to throw about; "semi," to sow; "dissemi," to disseminate.

"ek-" denotes beginning and momentary action: "brili," to shine; "ekbrili," to flash; "kanti," to sing; "ekkanti," to start singing.

The list of suffixes is considerably longer:

## SUFFIXES.

"-in" denotes feminines: "onklo," uncle; "onklino," aunt; "koko," cock; "kokino," hen.

"-et" denotes diminution of degree, etc.: "lago," lake; "lageto," pond; "varma," warm; "varmeta," lukewarm.

"-eg" denotes enlargement, intensity of degree: "domo," a house; "domego," a mansion; "varma," warm; "varmega," hot.

"-an" denotes an inhabitant, member or partisan: "Londono," London; "Londonano," Londoner; "Kristo," Christ; "kristano," a Christian.

"-aj" denotes concrete qualities: "mola," soft; "molaĵo," soft material; "amika," friendly; "amikaĵo," a kindness.

"-ec" denotes abstract qualities: "mola," soft; "moleco," softness; "amika," friendly; "amikeco," friendship.

"-id" denotes the young of, the descendant of: "kato," cat; "katido," a kitten; "hundo," dog; "hundido," a puppy.

"-ar" denotes a collection of things: "vorto," a word; "vortaro," a dictionary; "arbo," a tree; "arbaro," a forest.

"-ej" denotes a place where an action occurs: "lerni," to learn; "lernejo," school, "kuiri," to cook; "kuirejo," kitchen.

"-er" denotes one object of a collection: "mono," money; "monero," coin; "sablo," sand; "sablero," grain of sand.



"-estr" denotes a chief or leader: "sipo," ship; "sipestro," captain; "regno," state; "regnestro," ruler.

"-ist" denotes trade, profession or occupation: "drogo," drug; "drogisto," a druggist; "boto," a boot; "botisto," a bootmaker.

"-il" denotes a tool or instrument: "bori," to drill; "borilo," a gimlet; "razi," to shave; "razilo," a razor.

"-ing" denotes holder into which one object is put: "plumo," pen; "plumingo," penholder; "kandelo," candle; "kandelingo," candlestick.

"-uj" denotes container of material or a collection: "inko," ink; "inkujo," inkstand; "mono," money; "monujo," purse.

"-ul" denotes one remarkable for some quality; "brava," brave; "bravulo," a brave man; "bela," beautiful; "belulino," a beauty (feminine).

"-em" denotes propensity or disposition: "babili," to chatter; "babilema," loquacious; "kredi," to believe; "kredema," credulous.

"-ebi" denotes possibility (Engl. -able, -ible): "vidi," to see; "videbla," visible; "kredi," to believe; "kredebla," credible.

"-ind" denotes worthiness: "admiri," to admire; "admirinda," worthy of admiration, "memori," remember; "memorinda," memorable.

"-ad" denotes duration and continuation of action; "pafu," a shot; "pafado," shooting; "rigardi," to look at; "rigardadi," to view.

"-igi" denotes causing something to be: "morta," dead; "mortigi," to kill; "bruli," to burn; "bruligi," to set on fire.

"-igi" denotes the action of becoming: "ruga," red; "rugigi," to blush; "fluida," fluid; "fluidigi," to become fluid.

"-edz" denotes a married person: "doktoro," doctor; "doktoredzino," doctor's wife; "fratino," sister; "fratinedzo," sister's husband.

"-oj" denotes masculine affectionate diminutives: "Josefo," Joseph; "Jocjo," Joe.

"-oj" denotes feminine affectionate diminutives: "Florenco," Florence; "Flonjo," Flo.

"-um," indefinite suffix playing similar role in forming words as "je" amongst the prepositions: "plena," full; "plenumi," to fulfil; "vento," wind; "ventumilo," fan; "kruco," cross; "krucumi," crucify

\* \* \*

Dr. Zamenhof constructed the new language while he was attending school in the eighth class of the Gymnasium in 1878, and



he celebrates the fifth of December as the birthday of Esperanto. It is natural for a man of his type to be also poetical, and he celebrated his invention with a hymn, "La Espero in Esperanto," which is the favorite song of Esperantists.

It begins with the following stanza:

"En la mondon venis nova sento,  
Tra la mondo iras forta voko;  
Per flugiloj de facilo vento  
Nun de loko flugu gi al loko."

These lines are literally translated as follows:

"Into the world has come a new sentiment,  
Through the world is going a mighty call;  
On wings of light wind  
Now from place let it fly to place."

One of the most active advocates of Esperanto is Mr. Richard H. Geoghegan, of Seattle, Washington, a scholar of great versatility, who is not only familiar with European languages, including the Russian, but also with the Chinese and some languages of the American Indians.

He has written a grammar of Esperanto, and I do not hesitate to look upon his recommendation as valuable.

He writes as follows:

"I have used the language since 1887 in correspondence on linguistic matters and otherwise, with over 300 correspondents in all parts of the world, and have found it a true creation of genius. The more I use it the more I admire it. I have received hundreds and hundreds of suggestions for "improvements" during the past 15 years, but have yet to meet with a single one that, on practical experiment, is worthy of adoption. I have also used the language in conversation with a European gentleman, whose native tongue I do not speak,—nor he mine,—and during an entire day's social intercourse we had not the slightest difficulty in understanding one another. It is a marvelous adaptation of the existing truly international word material. Mi opinas ke Vi ankaŭ ne povas ne sat: kaj disvastigi ĝin?"

The first Esperanto Gazette was published by Mr. H. Bolingbroke Mudie.

The British Esperanto Association has its headquarters at 13 Arundel Street, Strand, London, W. C., and its official journal is *The British Esperantist*.

EDITOR.

## ON THE NOTION OF GOD AND THE PRINCIPLE OF RELATIVITY.\*

I do not propose to take up again, after so many famous writers, the development, or criticism of the notion of God. Still, we generally find this idea coupled with a logical and psychological question about which I wish to present a few remarks.

It seems indeed as though the traditional evidence concerning the notion of a personal God, ruling over the external world, had lost favor with philosophers, if not with theologians. The reason for this is easy to state. Whether this evidence is called cosmological or ontological; whether it is founded on analogy or the necessity of universal concepts; on contingency of things or inequality of natures; whether it appeals to the idea of being or the idea of good, of moral perfection; to the principle of contradiction or to the principle of causality, one and the same psychological situation is found under all the discussion. In such a debate we only give expression to what is already present in our thought; we oppose the positive term of a series to its corresponding negative term, and give actual existence to relations conceived in our minds.

It is a fact of common experience that the knowledge we have of ourselves implies a change in our states of consciousness. It is the same with the perception of self as of the motion of an external object: we perceive and determine motion only by the changes of position of the object with relation to bodies at rest or of a different velocity. That is why our concepts always imply the idea of a "relation" and are framed in what may be called contradictions.

We know that there are several kinds of these contradictions which do not always exactly correspond. Affirmation and negation, existence and non-existence, for instance, are not to be compared in every particular with other contrasts, such as absolute and contingent, infinite and finite, unity and multiplicity. The former concern existence which may be only affirmed or denied; the latter concern modes of existence, which are rendered comprehensible by their very opposition and do not at all exclude each other in the way in which non-existence excludes existence, or negation, affirmation. But they always practically imply a relation between opposite terms, whether these terms express pure concepts, either logical or numerical, or states of feeling, or moral ideas, as in the case of con-

\* Translated from the French by Amélie Sérafon.

trasts of a different order, such as pleasure and pain, desire and aversion, good and evil.

These contrasts, these antitheses indicate mere attitudes of mind; they represent our way of feeling and understanding; they are the forms of our affective and mental life, the conditions by means of which we become conscious of our relations with the external world, and connect the moments of our own personality. In this sense it is clear that everything is relative, that neither we ourselves exist, nor anything exists for us except by comparison with other existences. Thus the operations of our intelligence can be reduced to a faculty of forming series, the supposed last terms of which are to us a kind of concept-limit, not representable in themselves, and made intelligible only by the relations they symbolize.

As soon as we externalize these conditions of consciousness and sensibility, we create artificial contradictions. In fact, we cannot eradicate from our conception of things the imprint of our own mind, nor doubt the realities to which our own logic adapts itself. Neither can we, except by means of hypothesis, liken the capacity of our mind to the capacity of the universe, and we can only imagine, without ever attaining, a condition in which the consciousness of the subject might be the complete and perfect expression of the object.

Herein we find the defect of any kind of evidence that relates to metaphysics. To those who will admit no other source of knowledge than experience, theologians raise the objection that reason is a no less valuable source of knowledge. Still, reason is controlled by experience, and is entirely dependent on conditions of experience. We might even say, and it has been said before, that all knowledge is but sensation transformed or reflected.

Limited as it is by the law of relativity, our reason could never know God except in the form of a relation, which according to the expression of a neo-criticist, might be called "*relation par excellence*"; there is also the old argument of the schools, that it is not lawful to pass from the concept of existence to absolute, real existence. No doubt, great thinkers like St. Anselm, Thomas Aquinas, and Descartes, recognized the difficulties of such a subject. They found that a too close investigation of grounds of belief would have resulted in pantheism, that is to say, in the notion of God in nature and ruling it from within. For all this evidence implied after all the oneness of God and the world, since it seemed irrational to designate degrees or distinctions in the absolute.

Renouvier, who claimed to be a disciple of Descartes and Kant, undertook the task of opposing modern doctrines, whether naïvely dogmatic or thoroughly skeptical, and which, according to him, result either in a vague pantheism or discreet atheism, and according to which the individual and personality are nothing in the world but transitory phenomena, and the universe the outcome of a substance unknown to itself, and manifested in the infinity of time and space. God and the soul (which to him were one and the same idea) remained the center of his own particular doctrine. But in order to prove their existence and demonstrate the thesis of a providential or natural finality, he was obliged first to refute the realistic doctrine of the absolute substance, of that infinite "thing" without beginning or end, the development of which might be the universe; hence, to refute the doctrine of universal determinism. The principle of contradiction in which he takes refuge, would preclude attributing reality to any object which might be conceived as a composite of modes, qualities, parts, or distinct moments, of infinite and interminable number though actually acquired and imparted in all its unities. Moreover it would prevent accepting the essential predetermination of the future, for otherwise it would have to be admitted that every phenomenon occurring at present is the predestined result of an infinite number of former phenomena. This would be contradictory.

It is one thing to consider in our practical operations a first and last state, and it is another thing to conceive in the abstract a beginning and an end of things. We are at liberty to imagine the formation and destruction of a globe like our earth, because in this case we have a question of a succession of events which are real, determinable, divided for the sake of convenience in speech into the indefinite succession of cosmic accidents. But we may not speak of a beginning and an end in the absolute sense, and our thought itself refuses to admit a complete and sudden creation, a world extracted from nothingness. The words "beginning" and "end" are nothing more than symbols in this case. They represent an opposition the terms of which could not effectively limit the illimitable series of possible events. To any given magnitude you may always add another magnitude, and this is the only really clear expression of the primary fact of consciousness, under the pen of the philosopher as well as of the geometician.

In short, Renouvier's idealism also evades the laws of reason. Moreover, he acknowledges that he is compelled, for want of evi-

dence, to consider God and liberty as objects of "rational belief." And his belief finds secret, may be unperceived, motives in the classical arguments of the naive realism which he congratulated himself upon having cast aside. This shows that we all remain in spite of ourselves, both idealists and realists at the same time!

An article published in *The Monist* (Oct. 1905), over the signature of Henry Bedinger Mitchell, presents this serious subject in a new light. Mr. Mitchell first attempts to evade the difficulty of conceiving as a whole, as a unity, that which by definition is infinite. The oneness of an assemblage depends chiefly on the law which connects its elements, namely, on psychological action; and such would be the modern definition of the finite and infinite founded on this consideration—putting aside details—that it would justify us in affirming the characteristic of infinity in man and in passing from mathematical infinity to that of the theologians.

Still this first step is difficult to take. It seems indeed that the faculty we have of forming series, should remain the primary fact and that the new definition justifying our hold on the "infinite" were forever begging the question.

Mr. Mitchell does not dispute this fact. He admits that "intellectual" consciousness is relative and that our mind acts necessarily in multiplicity. Accordingly he attempts a bolder step. He makes a rather subtle distinction between assemblage meaning multiplicity and assemblage meaning unity: cognition of the first according to him belongs to the mind, of the second, to the "heart."

This is the process, he tells us, which is used by mystics and artists. But then, with what kind of reality have we to deal? Mr. Mitchell now undertakes to make these two methods, of reason and of the heart, conform to each other. This is the third point of his thesis.

The method of comparison, he writes, is reputed the only scientific one. It is considered an act of intelligence, the method of direct perception being reckoned an arbitrary act of imagination. However great the action of reasoning may be in the comparison preceding any kind of generalization, the conception of a general law is not the result of pure reason. It is a creative act, comprising selection, desire and volition, but never logical compulsion. Through this act, something new passes from the *potential* world into the *actual*. Amongst the infinitely numerous explanations required by a series of phenomena, we choose the corresponding type between these phenomena and our concepts. And it is not this liberty of

selection which causes the instability of the explanatory hypothesis, but the inherent weakness of the scientific method. We can only substitute a unity which is known to ourselves, because created by ourselves, for an unknown but *intuitively felt* unity. If facts lead us to it, the "heart" helps along; it does not deceive us any more than our senses do.

Is it not exactly this point, I would ask Mr. Mitchell, which gives value in the first place to the hypothesis in science? It necessarily participates in our researches. Science always starts from some conjecture, and then branches off with other conjectures into philosophy. The important question is to estimate what the conjecture or hypothesis is worth, and consequently shall we not be led to admit that its quality depends on the facts on which it is based, on the more or less broad and solid foundation on which it rests?

This discussion which started with the relativity of knowledge, is finally centered in the difficult problem, the range of sentiment. And now, if I am not mistaken, we are led back, as far as the notion of God is concerned, to what may be called the "naïve" way of thinking in which, after all, the believer holds his ground most firmly, and from whence I have not the slightest intention of driving him.

There remains for us still (to reverse a famous adage) to decide whether sentiment is truly a *prima cognitio*, and whether there is anything in the heart of man to-day, save the predominance of passions, which has not first originated in his head. However, I am far from rejecting in all cases the significance of sentiment, or the consequences which may be deduced therefrom. I appreciate Mr. Mitchell's clever argumentation in spite of the slight reservations which I have felt it my duty to make, but I acknowledge that I wonder at the attitude of those who, imagining that they possess an intuitive idea of the absolute, of the infinite, yet say that they feel humiliated at not being able either to represent or understand it. Furthermore I can not believe that our inmost self should have the privilege of feeling this absoluteness, the phantom of which our intelligence tries in vain to grasp. Neither can I make up my mind to give words to a meaning mysterious to me, nor do I expect so high a metaphysical revelation for a mere psychological state.

Far from renouncing the notion of God, I, on the contrary, agree with Dr. Paul Carus in affirming that it stands for too great an effort of the human mind, as well as symbolizing truths which

are too important for the conduct of life, for us to be so rash as to abolish it.

I only wished to show in these few pages the flaw in certain demonstrations, and if I were called upon to give a concise formula, expressing my exact thought, I would say that God is the *logical expression* of the universe—"the moral law of nature," writes Dr. Carus, and let us not aspire to greater enlightenment.

LUCIEN ARRÉAT.

PARIS, FRANCE.

### HUME VERSUS KANT.

*To the Editor of The Monist.*

In comment on some expositions in your *Primer of Philosophy* I wish to contribute the following observations on Kant's relation to Hume.

In answer to the question "Is Hume a skeptic?" I would decidedly say: No!

In order to justify my position it may be well to define the word skepticism.

Skepticism is the result of the dogmatical use of reason, without careful criticism (Kant).

Skepticism is that view according to which man can have only uncertain opinions, but no exact knowledge (Hume).

Skepticism is the result of reason throwing its light upon itself, thereby unweaving at night what it wove in the day, analogous to Penelope's texture (Rev. Rickaby). This last definition speaks for itself.

Radical skepticism flatly denies the fact that we can have a criterion of truth, yet the fundamental problem of all knowledge is this: Can we have such criteria? Indeed, if by constant truth is understood a judgment which has been for all time and will for ever remain recognized as valid, there is no truth. For every constant truth which has been heralded as such since the dawn of thought, has found many to deny it with abundant proof. But if there is no unconditional truth, we must assume as truth that which appears as such at this very moment, since the next moment may disprove it.

On the other hand, if we deny the objective measure of value



(criterion) of truth, science is no more. In its stead there will be nothing but opinion, no more definite direction of will, but arbitrariness (Willkühr) and fitful humor.

This fitly leads us to consider the relativity of knowledge. Where the radical and dogmatic skeptic is at error, is in his profession to have strictly proved his conclusions, and to hold it positively as a valid inference. Now this conclusion is either proved or not. If it is not proved, he has failed in his main object; if it is proved, then the many facts and principles which went to build up the proof, are thereby declared invalid; for they imply a large mass of human certitudes. His premises appeal to observed facts, which, however, he declares suspicious. "The modern theory of the relativity of all human knowledge," says Rev. Clarke in his *Logic*, "leads to philosophical skepticism; if all knowledge is relative, absolute truth disappears from the face of the earth."

In answer to Rev. Clarke, I quote Dr. Carus: "It is this very relativity of knowledge, so often impugned, that allows an indirect, yet most reliable, apprehension, where direct observation is impossible." I refer the reader also to Dr. Karl Pearson's *Grammar of Science*.

As a matter of fact, the final result of radical skepticism is disintegration and dissolution; since it applies but one measure, namely: the ever changing "I," this ego-centric view-point is a psychological atomism. Applied to knowledge it is solipsism. In action its formula is nothing but "I." Anarchism is its result in practical politics. In metaphysics it is mechanico-atomistic naturalism and its all-embracing term is nihilism.

Take a grain of wheat, follow its evolution, study the labor required to form it into bread, and it will become evident how much we are dependent on and related to our fellow-beings. "All human life would perish, if the skeptic principle were to reign supreme," says Hume in his *Enquiry*.

In practice there is no nihilist, in theory only do we meet that fiction of an abnormal brain. The moment the nihilist would put into practice his principles he would destroy his own existence. All beings from the moner to man are related to each other and to the universe. We cannot think of existence without relations, hence it is the greatest error of the individualists, that any living being stands for itself "alone one," that it is "an only one." As the atom in energetics so the isolated individual is a fiction.

Haeckel's *Philogeny* furnishes a proof. The life of the entire



chain of our ancestors and our progeny, in which we are but a link, and which surprises us at times with costly gifts, or loads our ship of life with fatal burdens, is the germ to which we owe our existence. We are the abbreviated race-history of our ancestry. The denial of this fact is insanity, for "nature is stronger than a principle" (Hume).

Nature rules by the punishment of destruction, of psychological degeneration and social discord, which is harmful to self-preservation, and still more so to the preservation of the species. Here we have criteria of truth, if not theoretically recognized yet practically operative and not to be disregarded. This condemnation of radical skepticism does not indeed include the skeptic attitude of mind which is so wholesome for science and true progress.

Now, since for practical purposes we are obliged to accept *criteria veritatis*, we have several ways by which it can be done. First, we may follow Plato and Spinoza whose principle was *conception*. By trusting in human understanding we are required to understand clearly and distinctly (*clare et distincte percipere*). The law here is this: Everything is a truth which does not contain a contradiction. Secondly, we may choose *revelation* as the irrationalists and philosophers of faith (the religions of revelation and their defenders, St. Augustine, Luther, etc.). The requirement is to believe in the revealed word of Sinai, Bethlehem or Mecca. Thirdly, we may accept *experience* as the empiricists (Protagoras, Epicurus, Stoa, scholastic nominalism, Bacon, Hobbes, Locke and their following). Here is taken for granted only what man experiences by or through his five senses.

Experience, or rather the conclusions drawn from the solution of the problem of experience, is seemingly the cause of the divergence between Kant and Hume. Experience, as Dr. Carus points out in his *Primer of Philosophy*, is an ambiguous term in Kant's terminology and may lead to confusion.

Kant seems to have misunderstood Hume, owing probably to the fact that Kant did not understand English. The translation of the *Treatise* by Jakob in 1790, came to his hand after the three critiques had been completed, and he had only seen the *Enquiry* prior to that. Nevertheless, some of Kant's criticisms of Hume are justified, namely, as regards the theoretical foundation of the validity of causation, while he believed in the validity of mathematics.

Impression is Hume's legitimation of truth, while Kant calls *atsight* (*Anschauung*) without conception blind, and conception

without at sight empty. Both views may be reconciled to the fact that experience is the determining criterion of truth. The conception of experience forms the stumbling block of reconciliation. Yet, everything points in Hume's favor and Hume's influence is growing. I mention Mach's psychological studies simply as a proof, as also Ostwald and Avenarius, all of whom may be called New-Humists; likewise Theodor Lipps in his foreword to the translation of the *Treatise on Human Nature*, where between the two (Kant and Hume) he apparently prefers Hume. That Hume was the first to found a biological theory of knowledge has been recognized by Alois Riehl, and also Windelband gives him the same credit in his *History of Modern Philosophy*.

If skepticism is limited to the consideration of metaphysics or means a denial of metaphysics, Kant can have no reason to criticise Hume, for in his *Prolegomena*, and in the last part of his *Critique of Pure Reason*, he also denied metaphysics. Hume is no skeptic in mathematics for which he accepts the view-point of rationalism. As far as the realm of perception is concerned we could almost call him a sensualist so strongly does he affirm perception. I rather class Hume as a relativist or positivist, like Comte and Mill. Hume's criterion could not satisfy the logician Kant, but did he himself find one more stable? However, both accept experience as the bottom rock of subjective certitude. Kant, the logician, naturally attempts the solution from the logical side, for which reason we see most logicians follow him to-day. The psychological side is Hume's contention, hence we find the psychologists and phenomenologists to a great extent among his followers. The causal theories in this controversy stand in the same relation that realism does to nominalism, if scholastic language be permitted. The problem does not lie in experience proper, but rather in the conclusions reached. The question of this divergency has received another solution by J. Mirkin from the mathematical side in his *Dissertation*, 1902, which may be compared with Dr. Carus' exposition of the Problem of Experience, in his *Primer of Philosophy*. It is true as Dr. Carus states that Kant's misunderstanding may have been due to Hume's wrong conception of cause.

Hume's three principles of association of thought (similarity, identity, etc.) are, in my opinion equal to Kant's synthetic judgments *a priori*. That there are psychological truths, establishing a coercion at sight, is Hume's claim, and that there are logical truths which include a coercion of thought; these claims are perhaps more valuable

than Kant's schematization, which has been shattered by Adikes. Even his student Schopenhauer may be mentioned in this connection. The logical truths of Hume embrace the Kantian categories according to Mirkin.

Kant's criticism never holds good when it relates to the view Hume held on mathematics. Kant criticised the *Enquiry*, not the *Treatise*, as is proved by two passages in the latter. Here Hume himself states that the deduced propositions of mathematics can be obtained by sense observation, i. e., in Kant's language, they are synthetical. Hume has grasped the problem of knowledge much better than Kant by his careful distinction of conceptual (mathematical) knowledge and the knowledge of facts. (Leibnitz' *veritates aeternae et veritates de factu*.) Kant in this regard turns against himself. The conception of substance has been more completely destroyed by Kant's predecessors than by himself. Again: "Nor can there remain any suspicion that this science is uncertain and chimerical; unless we should entertain such a skepticism as is entirely subversive of all speculation, and even action. To throw up all at once all the pretensions of this kind may justly be deemed more rash, precipitate, and dogmatical than even the boldest and most affirmative philosophy" (*Enquiry*). What does that mean, skepticism or criticism? And again: "Mathematics is justified because its synthetical judgments *a priori* are established in the pure at-sights of space and time. Is there such a thing for metaphysics? No. Hence it is unfounded" (Kant).

Hume in his *Treatise* says: "The conception of existence does not differ from the conception of a thing."

Kant's assertion in the *Prolegomena* and the second edition of his *Critique of Pure Reason*, that "Hume cut off from the field of knowledge pure mathematics," falls flat if one reads the *Treatise*. Part 4 of the *Enquiry* led Kant to this error. Kant indeed lets the understanding give rise to the synthesis, instead of Hume's imaginative faculty. It is further true, that wherever Hume places belief in the external world or in the validity of the categories forming it, Kant speaks of necessary *a priori* present functions of the understanding, which condition experience, or rather first make it possible.

Humists call experience complexes of sense-impressions which by means of general habit involve a psychological coercion etc.... the product of an imaginative faculty is an instinct, which manifests itself in the belief of the external world. The instinct and belief are sufficient for Hume. Kant calls that skepticism. Such criteria

are too effeminate. Although Kant accepts the productive, imaginative faculty also, its function of unification of "synthesis" returns in Kant's transcendental unity of apperception, the silently accompanying "I" in thought, which accompanies all our notions in a latent state.

Forms of at sight (space and time) and forms of thought (categories) take the place of imaginative faculty and belief. The divergency, it seems to me, is a question of temperament and consequence. Hume traveled a great deal, lived in France and came in contact with practical life almost daily, while Kant buried himself in his books, excepting only his walk to the university or his promenade with Lampe on the "Philosophen-Steg." He was like a wound-up clock, and Heine says of him that people used to set their watches according to his movements.

Kant looks on the problem of experience from a logical side, Hume from the psychological. Kant is a realist of conception and his sense of order comes in conflict with the relativist or nominalist. Experience is the product of thought in the *Anschauung*. A judgment must precede the impression before it becomes experience, it is the *conditio sine qua non*. Experience follows understanding. Hume says experience follows the faculty of imagination. But such an assertion would attribute the function of synthesis to the imagination, while the understanding has this function according to Kant. The form, in regard to the function which realizes it, is the act of the union of matter; by its means the isolated states of the parts are overcome. That which is individual in the impression is connected in our consciousness. In this connection I mention Lewes, *On Sense Verification*.

The real problem is this: How does the unity of sensation arise from the plurality of impressions? The best answer that I can find is given by Dr. Carus in his books *The Soul of Man, Whence and Whither?* and *The Religion of Science*. Hume says that it is the product of habit; Spencer, that it is inherited (biological); Kant, that it is a creation of the understanding. The pre-existence of conceptions, I think, we may discard, for how could the anthropoids have these forms of at sight or the categories?

As is seen, Hume's synthesis is formed by imagination and faith, and Kant's by sensuousness and understanding. The causal problem was correctly put by Hume, Kant admits, for logically no one can expect that if I say one, two necessarily is to follow. Hume explained this biologically, Spencer led those postulates of Hume

to a consequent conclusion. Hume did not recognize that causes are successive stages of a routine experience, that necessity belongs to the world of conception, not to that of perception.

Hume chose the biological and only correct point of view, whence, however, Kant again departed. Kant knew and applied this view-point in his *Theory and History of the Heavens*, but in regard to the inner cosmos, the laws of the development of human consciousness, he was wrong.

The mere sense-impression is as little to Hume as experience is to Kant. Experience is the synthesis of the manifold impressions with the unity of an act of consciousness. But whence this synthesis, this function?

Hume as well as Kant answers, from two sources. But the former traces it from psychology; the habit which generalizes the uniform process of the life of nature, the belief in the correctness of our own psychological instincts: and from a logical source; the relational conceptions (identity etc.) and the category of relations. While Kant derives it from sense-perception and understanding which in their deepest root may be identical.

I might ask Kant, where does the parting wall lie between man and animal, and when begin these *a priori* insights, and the forms of thought, our birth-dress, in their souls which to him seem to be like *creatio ex nihilo*? Darwin and Spencer show that they developed. The psychology of Hume went deeper than Kant's, hence Hume comes closer to the results of present researches than Kant does. Hume gave the incentive to Stallo, Clifford, Mach and Ostwald. "Logical truths relating to the proposition of identity are irrefutable," says Hume, and he is apparently right. Mathematico-analytical laws are unconditioned and their contraries are unthinkable, while empirico-natural laws (gravity, conservation of energy, etc.) are valid under restrictions only.

The mathematical laws are apodictic, the physical laws are only assertory. The discovery of the different rays, radium etc., cannot be reconciled with atomic and ether theories, and science dropped the law but not the fact; therefore Hume is right. *Ergo*: Every natural law is valid, because it is based upon causality, hence we rely on experience, until it is reversed by new facts. The fact of experience is the criterion of truth, not the conception, not revelation. Thus it is seen that Hume is right. Kant, the rationalist, stuck to the pre-existence of conceptions, but how are we to reconcile his idea with the researches in biology and psychology? Hume

finds an explanation for Kant's ready-made functions. The symbols of mathematics and their values are human inventions, creations, and their conclusions cannot be canceled by any new facts. But the universe is not made of such numbers, angles etc., hence our logical truths (our creations) are incontestable. In this regard Helmholtz adheres to Kant while the New-Humists follow Hume. It is Hume who said: "Logical truths based on the principle of identity are irrefragable. No experience can add to or detract from these facts."

What are our analytical judgments? Nothing but those ideas which have been previously combined by synthesis and can be evolved from the combination. This means that they are ours by ancestral inheritance which is discovered as soon as we open the safe of logic. As long as we deal with logico-mathematical truths like Euclid's theorems our generalizing judgments remain valid.

WILLIAM MEYER.

WEST HOBOKEN, N. J.

### THEORY OF LIMITS.

In *The Monist* of July, 1905, in an article entitled "A Circular Polygon," Mr. Baker states that "the subject of limits as taught in elementary text-books is very crude and fogged with lack of perspective."

To this statement careful students will doubtless agree, but they will not likely accept all other conclusions expressed in the article.

If, as a variable assumes successive values *according to a given law*, it can be made to differ from a constant by as little as we please, but cannot be made equal to it, the constant is called the limit of the variable.

Of course, if the law of formation of the successive terms is altered, the limit may be altered, or may no longer exist. Thus in the examples given, in one case the horse gets out of the stable and in another case he does not.

But even this definition of a limit assumes that the constant has an existence independent of the variable. In many cases the limit is tacitly postulated and properties assigned by analogy. I believe this is a very common fallacy in current proofs concerning limits. Writers considering only variables having rational limits

are apt to overlook the limitations of their methods and to make hasty generalizations.

For example, we readily see that the limit of

$$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$$

is the known number 2. But consider the series

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$

By using similar methods can we say that "the sum is easily seen....to be exactly" some definite number, and that "there is no unattainable limit, no residual error"?

If a curve is a line no part of which is straight, there is *by definition* an insurmountable barrier to the derivation of properties of a curve from those of a straight line.

It would hardly do to define circles as lines of constant curvature, since the measurement of angles involves the use of circles, and also the definition would involve the length of curves in general—a problem not always satisfactorily dealt with in the case of the circle itself. Moreover, it is probably not until we study calculus that we can show that lines of constant curvatures do not include loci other than circles and straight lines.

A comparison of the properties of a variable figure with those of its limit is instructive, but we must not assume that the latter can be logically derived from the former. I do not believe we can derive the properties of a tangent to a circle from those of a secant, any more than we can derive them from those of a line without the circle and approaching indefinitely close to it.

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## BOOK REVIEWS.

FOUNDATIONS OF SOCIOLOGY. By *Edward Alsworth Ross*. New York: Macmillan Co. 1905. 12mo, pp. 410.

One of the chief effects of the christening of sociology with this name in 1842 was that for a full generation thereafter more arrant nonsense was written upon the subject than had been written in any previous period of several times that length. Numbers of unaccountable and invariable laws of sequence of social phenomena were announced; while on the other hand such writers as Ferrier and Goldwin Smith denied the possibility of any science of history. It was certainly an advance upon this state of things when Mr. Lester Frank Ward, in 1883, inaugurated the doctrine that sociology rests upon psychology, that the only social forces are the desires of individual men, and that these are controllable just as physical forces are controllable. It was an undeniable advance even though it involved some error. It is true that individual impulses are the only social forces to the same extent as it is true that the characters of any race of animals are the characters of the individual animals of that race. But is this quite true? Every census of the United States shows that among the native whites there are a few more males under one year of age than there are of females, (in 1900 as 38 to 37), while among the negroes it is the other way (in 1900, as 102 to 103). Here is a characteristic of each race, as it lives in the United States. Yet it cannot properly be called a characteristic of individual whites and negroes, though it is a character of statistics of individuals. It might be said that the *causes* of statistical characters lie in the individuals. But this would be a confusion of thought due to not remarking that a noun in the plural number does not denote the same sort of object as the same noun in the singular, but a *collection* of such objects. For most nouns and for most purposes the distinction is insignificant. But for the noun "individual" it is highly important. A character of individuals which is not a character of any one individual is a character of a collection of which any member is an individual. It is not an individual character, but is a collective character; just as the character of a molecule is not a character of an atom, just as a character of an ocean wave is not a character of sea-water.

Professor Ross is a close adherent of the position of Dr. Ward. If our readers will permit us to use the word "impulse" to denote that real determination of man's nature to which desire corresponds in consciousness, Professor Ross's opinion is easily explained. He holds it to be axiomatic that nothing but individual desires are the sole true causes of all social phenomena,



unless external circumstances be called causes. "How differently," he exclaims, "should we conceive the tasks of crystallography if we could question the molecules and learn just why they comport themselves as they do! How otherwise should we describe chemical processes if the atoms could tell us of the affinities they obey!" These exclamation-marks bespeak an absence of doubt which is not easily reconcilable with much reflection on the subject. For upon the same principle it should not be personal desires, at all, that are the true causes of action, but the impulses of the individual cells of the person's body. It is hard to imagine how atoms think. Let us rather consider the case of those insects which take the most sedulous care to lay their eggs where their progeny will find suitable food, although neither they themselves nor any insect of their species has any experience of such eggs producing any living creature. If such an insect could tell us why she took such pains about the place in which she deposited her eggs, we know pretty surely what she would say. She would say, "I do it because I want to," or if she were of a metaphysical turn of mind, she might reply with the *hysteron proteron* that she did it because it afforded her gratification, the truth being more nearly that it affords her gratification because she has an impulse to do it. She certainly would not dream of giving the biologist's answer, that she does it because the instincts of her race suffice for the preservation of the stock. Is her answer so much more adequate an explanation than this of the biologist as Professor Ross's exclamation-points would imply? If we are asked how we know that she would answer as we have said, we reply that we infer that she would because men give analogous answers. Ask a man why he does something, why he entertains the purpose that he alleges in reply, and push your interrogatories, and you will very soon come upon one of those forms of desire which are common to all men, and of which the individuals have no explanation to offer. But such instinctive desires seem, in all cases, to be favorable to the preservation of the stock. Thus, a drunkard drinks "because he wants to drink"; and it seems to be conducive to the preservation of the race that he should go on drinking, since he will so diminish the number of his probable offspring that will reproduce in their turn. Professor Ross would no doubt say that the drunkard's desire for drink, like the insect's desire to lay her eggs in a peculiar case, is a first cause of which no explanation will ever be possible. Few psychologists will agree with him. He does not perceive that a proposition asserting that every social law has this or that character is itself the enunciation of a true or false social law, and furthermore of a law which does not consist in individual desires; so that, if any such proposition be true, there must be at least one social law which does not consist in individual desires.

Professor Ross raises another objection against the logic of every general law which has been put forward and which does not consist in individual desire. The objection is that all such laws "rely unduly" upon the analogies of other sciences. But how does he prove this extraordinary law that a sociological law suggested by a similar law in another science is necessarily false? He professes to prove it by the analogy of other sciences. So here is a law resting solely on the analogy of other sciences which law declares that every *other* law like itself is false,—for no doubt it makes an exception in its own favor. But there are three very substantial replies to be made to this

sweeping objection. The first is that, so far is Professor Ross from historical truth when he says that "no recognized science borrows its laws from other departments of knowledge," that there are very few sciences which have not passed through crises in which the fogies have made a great outcry against the analogical extension of some principle from another department of study; and these crises have for the most part resulted in the confirmation of the analogy. Thus, paleontology originated in a violent protest against those who proposed to explain fossils by the analogy of the skeletons and other remains of known animals and plants. One of the crises of astronomy came when certain astronomers proposed to extend the "natural motion" of terrestrial bodies to the celestial bodies. The fogies insisted that "nothing was gained" by comparing two kinds of bodies so radically different. Physiology had its crisis when explanations of vital phenomena were first drawn from the analogies of inorganic physics and chemistry. Chemistry had its crisis when organic bodies were first explained as analogous to inorganic bodies, and organic chemistry was thus reduced to the science of carbon-compounds. Logic had one crisis when it was explained by the analogy of quantitative algebra; and it had another when the logic of relations was explained by the analogy of Boole's algebra of logic. Optics saw a struggle when it was proposed to explain light by the analogy of waves. So it runs all through science.

The second reply to the above objection should be prefaced by the remark that the analogical extension of a principle from one science to another does not take place according to that form of argument to which a strict ethics of terminology requires that the term "the argument from analogy" should be limited. That argument occurs when there are a number of objects, A, B, C, D, etc., and a number of characters  $a, b, c, d$ , etc., each of which characters is possessed by each of those objects, and when there are an additional object Z, and an additional character  $z$ , such that Z is known to possess each of the characters  $a, b, c, d$ , etc., and  $z$  is known to belong to all the objects A, B, C, D, etc. These premises constitute a relatively strong probable argument that Z possesses the character,  $z$ .

But there is seldom or never any argument of this strength, at the outset, to support the extension of a principle from one science to another. In the first instance, an examination of facts shows some of them to have a character which they certainly or probably would have if the extension were valid. This is an argument of a kind that has been called an abduction. It suffices only to show that the facts are more or less like what they would be if the theory of the validity of the extension were true. In that sense, and in that sense only, this argument from consequent to antecedent renders the theory "likely." It suggests that theory, and prompts an inductive investigation. This inductive investigation must not, like the abduction, begin with a scrutiny of the facts, but with a scrutiny of the theory, in order to find necessary consequences of it which are capable of being compared with the facts. In other words, it requests the theory that is on trial to predict the results of observations yet to be made, and which it should be able to predict if it be a true theory. When some considerable predictions based on the theory have been verified, while none have been falsified, the theory ought to be regarded as provisionally established. Now it cannot be disputed that the inductive testing of sociological theories by predictions or quasi-predictions has usually

been of a very slight kind; and it may be that Professor Ross, with his intimate acquaintance with sociological literature may be able to specify cases in which the mere abductive argument has been offered as sufficient proof. But as far as the reviewer is aware, it never has been pretended that it had any value other than as a suggestion. Now Professor Ross himself admits that "the extension into the social sphere of regularities discovered in other fields has greatly helped to bring order out of chaos." That being the case, he has altogether failed to show that there is any definite sense in which his wholesale condemnation of a general "undue reliance" upon analogy has any justification.

The third reply to Professor Ross's objection to the "undue reliance" upon analogy,—that is, upon the mere abductive argument,—is that he has not, with all his great learning, been able to adduce a single marked example of such least intention of defending the truth of those laws. We think the evidence of them is flimsy. But we do protest that they do not exemplify undue reliance upon abductive reasoning, since they do not take their rise in the observation of analogies, but in an *a priori* argument that in the nature of things there *must be* such analogies. Spencer maintains that a society is, and must be, built up of individuals, just as the individual is built up of cells, and therefore there *must be* a perfect parallelism between the laws of individual phenomena and of social phenomena. He thereupon proceeds to trace out this parallelism in detail, and finally he offers more or less inductive evidence in confirmation of it. One may deem such an argument stronger or weaker than if it relied upon observed analogies; but it certainly has a widely different character from such an argument and altogether fails to illustrate that "undue reliance" upon an observed analogy of which Professor Ross complains.

We certainly should not have gone to the trouble of making the above criticism if it were not that, in spite of them, Professor Ross's work is a strong and valuable one. The style is sufficiently simple and agreeable, and is occasionally brightened by an apt metaphor or telling phrase. "Race suicide" of which we have heard so much is a term of Professor Ross's invention. The book carries the reader along, and gives not merely the author's own views but all the chief general sociological theories of the day in such a way as to impart a lively interest in each one singly, and still more in the disputes to which their conflicts give rise. In this respect, Professor Ross shows a talent that is all his own. The book is moreover rich in illustrative facts; and our readers will thank us for calling their attention to it.

C. S. P.

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THE WORLD'S DESIRES, OR THE RESULTS OF MONISM. By *Edgar A. Ashcroft*.

London: Kegan Paul, Trench, Trübner & Co., 1905. Pp. xi, 440.

Edgar A. Ashcroft is an Englishman who possesses sufficient earnestness and boldness to treat the religious problem with frankness and enthusiasm, a case which is quite unusual in England if we except the small party of free-thinkers who excel mainly in negativism and combativeness.

The title of the book is explained in the following paragraph quoting from the end of the Introduction:

"The sum of the best products of the world's thought and the world's

experience, ripened to fruition by the truly marvelous progress of nineteenth-century scientific discovery, now offers for this purpose—to satisfy the soul's needs of humanity; to enable mankind to bring his beliefs and his life into logical accord and harmony with his advancing intelligence and experience—a new religion, or an old philosophy, call it which we will, which is summed up in the title 'Realism'; and we believe that a general acceptance of this religion and its carrying out on a national and international scale, will satisfy the world's desires, and stimulate and foster the growth and advancement of mankind, by natural processes, to an extent, and possibly at a speed, which will prove surprising to minds schooled, as are ours, to the pessimism of a dualistic or passive agnostic outlook. Only then, we believe and shall attempt to show, can mankind walk in the narrow pathway that leads to reality; and attain to those mansions of the Blest, which are potential possibilities for the human race, as foreshadowed by the ideals of its numerous creeds."

The author, though very critical in religious matters, and following the lead of Ernst Haeckel, is anxious to have the religious and sentimental needs of mankind satisfied. He wants guidance in life and tenable ideas based on truth (see page 33), but he finds the established religions lacking in scientific truth, and philosophical and scientific reformers not sufficiently appreciative of the needs of man's soul. For this reason he ventures to build up a religion of his own, and quotes the old hymn:

"Faith will vanish into sight,  
Love in Heaven will shine more bright,  
Therefore give us love."

He sums up his aim in the following words:

"Let us borrow and re-apply the ecstatic words of St. Paul and express our thoughts thus: 'Eye hath not seen nor ear heard, neither have entered into the heart of man to conceive, the things which God hath prepared for those that love him.' We care not for the word 'God'! The human emotions which prompted St. Paul to worship his God are the same feelings, the same properties of matter and its marvelous organisms, which induce in us the lofty contemplation, (if you will, worship), of all that is good, all that is true, and all that is beautiful. And the most beautiful, good and true things that life has revealed, in all its ages, to mankind, are just those organic phenomena of human love, sympathy and fellowship."

The main treatment of the book is a review of human knowledge and the application thereof to man's political, social and ethical life. It is here where the author in the interest of his main cause might have been economical. For though his review of human knowledge is very well done, all its details are not essential for the author's present purpose. Mr. Ashcroft looks to the future not exactly with glowing optimism but with confidence, and he expects that in the long run mankind will be organized so efficiently as to realize the ideals of a religion of science, of truth, or realism. This organized will of mankind is the ultimate aim of human history. Mr. Ashcroft says:

"The will must be so developed as to harmonize with all natural forces, and the intelligence so cultivated as to secure the power to gratify this will."

Mr. Ashcroft having explained the main truths of physics, chemistry and other natural sciences, proceeds to state that the most marvelous faith in the world is the rise of the human soul. He devotes considerable space to the mechanism of living organisms, and then points out the great truth that the development of character is the chief aim of man's life.

He concludes with quoting Henley's noble lines:

"Out of the night that covers me,  
Black as the pit from pole to pole,  
I thank whatever Gods may be  
For my unconquerable soul.  
In the fell clutch of circumstance  
I have not winced nor cried aloud,  
Under the bludgeonings of chance  
My head is bloody, but unbowed.

"Beyond this place of wrath and tears  
Looms but the horror of the shade,  
And yet the menace of the years  
Finds, and shall find me unafraid.  
It matters not how strait the gate,  
How charged with punishments the scroll,  
I am the master of my fate:  
I am the captain of my soul."

The author is so radical as to be an infidel in the eyes of the old-fashioned Christian, yet his sympathy with religious sentiment and his use of traditional religious phrases shows that he is kin in spirit with the notable religious minds of the past, and though the viewpoint from which he writes has radically changed, the moral earnestness and seriousness is the same as the spirit that pervaded both the Decalogue and the Beatitudes.

**BUDDHIST AND CHRISTIAN GOSPELS.** Now First Compared from the Originals. Being "Gospel Parallels from Pali Texts" Reprinted with Additions. By *Albert J. Edmunds*. Third edition. Edited with parallels from the Chinese Buddhist Tripitaka by M. Anesaki. Tokyo: Yuhokwan, 1905. Pp. xiii, 230.

This work is the culmination of some twenty-five years of scholarly research which Mr. Edmunds has given to the careful investigation of the canonical writings of Buddhism. His knowledge of these is as critically thorough as a theologian's knowledge of the Christian Gospels, and in the parallels he has drawn between the two canons he distinguishes on both sides between the most authentic text and later interpolations, and also apocryphal or extracanonical writings.

The parallels exist more in the spirit and intent of the passages quoted, than in the words. There are eighty-eight in all besides six uncanonical parallels which form an appendix. The first three deal with analogous details of the birth and infancy stories of both religions; then follow five dealing with the initiation of the two great teachers, the Christ and the Buddha; thirty-three more deal with incidents during the ministry of each leader and corresponding ethical teachings; the next nineteen compare similarities in

their characters and attributes, and the last division contains the closing scene of the two eventful lives followed by corresponding prophecies in the two religions about the future of the life of the Church and the eschatology of the race.

Mr. Edmunds's work is supplemented by that of the Chinese editor, Professor Anesaki, of the Imperial University of Tokyo, who adds parallels and notes from the Chinese Buddhist Tripitaka. The technical book-making of the Japanese publishing house is excellent, but it is greatly to be deplored that the distance between publisher and author made English proofreading impossible beyond what could be done in the Oriental house. In consequence many typographical errors have crept in which could not have appeared in an English-speaking country, and many others which should have had the author's personal supervision. The most important of these are corrected in a rather formidable list of errata. There are no such disadvantages, however, in the Chinese quotations which were inserted under the care of the Editor.

In an historical introduction of fifty pages Mr. Edmunds writes of the antiquity of the Pali texts and the place of the Nativity Suttas in the Buddhist canon, as well as a critical discussion of the texts of the Christian Infancy Sections which he believes "to be cast in the same mould of Asiatic legend." On the principle that nothing should be regarded as borrowed "unless proven by express reference, by identity of text or sequence of narrative accompanied by demonstrable intercourse," the author tries to inquire into a possible historical connection between Buddhism and Christianity. His arguments in favor of this conclusion are of general interest.

Alexander the Great took three thousand Greek artists and actors with him into India and these laid the foundation of a long intellectual connection between Hellenist and Hindu culture. Aristotle conversed with a Jew in Asia who belonged to a sect around Damascus that was derived from the Hindu philosophers. Aristotle says that he received more information from this man than he gave in return. Alexander had decreed that there should be intercourse between Europe and Asia so that the two continents might become homogeneous and established in mutual friendship. His successors were animated by the same spirit and, working to the same end, sent ambassadors to India with instructions to write a description of the country. A Hindu king of this period sent to Antioch for a sophist, and his son Asoko (3d century B. C.) brought Buddhism to the notice of the Hellenist kings. Clement of Alexandria and others quote passages from a writer of Asia Minor that show a knowledge of Buddhism and other non-Brahmanic sects. About 110 B. C. the Greek king Menander (in Pali, Milindo) had a discussion with a Buddhist sage which is preserved to us in the Questions of King Milindo. This work (in which the Pali Pitakas are first immanent) shows that intelligent Greeks were inquiring into Hindu philosophy. Later, in the time of Augustus, Horace mentions an Indian embassy to Rome. In the time of Christ, Strabo saw a hundred and twenty ships ready to sail from the Red Sea to India, and coins of all the Roman emperors from Augustus to Hadrian are in the Museum at Madras. The title "good physician" as used in the apocryphal Acts of Thomas is not Christian but Buddhist. It does not occur in the New Testament but is found in the Buddhist canon.

"In the first century, or perhaps in the second, there reigned in the valley of the Indus the Buddhist Emperor Kanishka, whose famous council did so much to give political prestige to patristic Buddhism. One of this monarch's coins, which has come down to us, actually has on it the image of Buddha, with his name in Greek letters:

BOΔΔO

"Wherever this coin circulated the name of Buddha would be known, and many a Greek may have seen it for the first time thereupon."

In the first century people from India were living in Alexandria and the influence of their fables is traceable in the Talmud; and in the same century a manual of the Egyptian trade with India was written. Within about two centuries of the beginning of the Christian era mention was made by Virgil, Horace, Pliny and Clement of Alexandria, of distant people of Hindu origin who, according to the descriptions of these writers, are presumably none other than the Buddhists in China. Two incidents of the second century are noteworthy: (1) the mention of Buddha by Clement of Alexandria, and (2) the finding of the Gospel of Matthew in India, and by the end of the fourth century the doctrines of John had been translated by the Hindus as well as by the Syrians, Egyptians, and Persians. Possible allusions to Christianity have been noticed too, in the great Indian epic, the Mahabharata.

By these and many other incidents Mr. Edmunds shows the possibility of intercourse between the East and the West in the times of the establishment of Christianity; between Rome and the Ganges by way of Alexandria, Antioch and Bactria. This intercourse being proven he tries to show that Buddhist influence is traceable in the Gospel of Luke and this not in identity of text (except a partial verbal agreement between the Anglic hymns) but rather in the matter of sequence of narrative.

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DER VORCHRISTLICHE JESUS. Von William Benjamin Smith. Mit einem Vorworte von Paul Wilhelm Schmiedel. Giessen: Alfred Tötelmann, 1906.

William Benjamin Smith's work on the prehistoric Jesus, published in a German translation before the original appeared, and prefaced by his most eager antagonist Prof. Paul Wilhelm Schmiedel of Zürich, is a most remarkable phenomenon in the history of theological literature. Theologians as a rule are suspected of partiality, and the *furor theologicus* has become proverbial, yet Professor Schmiedel who represents the traditional and more orthodox stamp, deems it wise to have this most radical conception of the origin of the Christ ideal made accessible to the German theologians. He explains in the preface that these errors need refutation, and if they are errors they ought to be easily refuted, yet finding them so ably presented he challenges his colleagues to assist him in working up the field and combating the common danger.

Professor Schmiedel sums up Professor Smith's theory as follows:

The doctrine of Jesus is pre-Christian. It is a cult which between 100 B. C. and 100 A. D. had become current among Jews, and especially among the Hellenists, veiled more or less in mysteries. Christianity took its origin from several foci, and only according to a later theory from one alone, viz.,



Jerusalem. Jesus was from the beginning nothing but a deity, namely,—the liberator, the preserver, the saviour, the Nazarene. He was called Nazarene not from a town Nazareth, which in those days did not exist, but according to the Hebrew sense of the word, viz., the preserver. His *anastasis* meant originally his being put up in the sense of being installed, viz., as Messiah, the dispenser of the world and judge of the quick and the dead. Later on the addition "from the dead" modified the meaning of the term which henceforth signified "resurrection." There were two doctrines, first the one of John the Baptist, more severe and stern, proclaiming the advent of the Christ, the Messiah; and the other more gentle one of Jesus. These two were originally different movements, but they were finally merged into one religion culminating in the ideal of Jesus Christ.

Further, Smith claims that the Epistle to the Romans was not known before the year 160 A. D., and its authenticity is thereby seriously questioned. Professor Schmiedel has risen as an adversary to Smith, and has criticized his view in the *Hibbard Journal*, January, 1903. Accordingly, Schmiedel can not be accused of being a partisan who advocates Professor Smith's cause for trivial or personal reasons. On the contrary, he introduces him to the theological public because he deems it a duty to have the problems of Professor Smith discussed, and if possible finally disposed of. These questions Schmiedel claims are not unessential accidents, but the most essential part of Christian doctrines forming the foundation of our religion.

Professor Smith, though not a theologian, (for he is professor of mathematics at Tulane University) is so well equipped in theological knowledge that he deserves a hearing, and a refutation of his views will prove no easy task. The book needs deep study and can not be hurriedly digested, for the array of facts is formidable and learned, and it takes a special theologian to enter into Professor Smith's arguments. Specimens of his work have appeared in the *Hibbard Journal* and in *The Monist*. The *Hibbard Journal* contained an article on the Epistle to the Romans which is analysed into several fragments of different origin. His *Monist* article treats the very difficult problem of the Nazarene, in which for the first time he propounds his theory of Jesus the Nazarene as a pre-Christian deity of a Gnostic sect. The present book is not yet a complete exposition of Professor Smith's theory, but merely a preliminary statement of its most essential points fortified by argument, the strength of which seems to take hold of the reader gradually. The book contains five chapters: (1) The Pre-Christian Jesus. (2) The Meaning of the Epithet Nazorean, (3) Anastasis, (4) The Sower Sows the Logos. (5) *Sæculi Silentium*.

We have set forth our own views concerning the origin of Christianity in a number of articles published partly in *The Monist*, partly in *The Open Court*, and we find Professor Smith's views similar in many respects. Like him we insist that Christianity has originated from a pre-Christian movement, and almost all its essential doctrines have been prepared by religious sects which were more or less due to the syncretism that originated from the mixture of the nations after the conquest of Asia by Alexander the Great. Gnosticism was a pre-Christian movement, and the religion of the Nazarenes was one among many kindred movements. Mithraism, the reverence shown to Apollonius of Tyana, the Greco-Egyptian sects such as the Therapeutæ,



also the worship of Hermes Trismegistos as the divine word, and the continuation of the worship of Ptah, the word from whom the world had been made, were products of the same general movement. It is therefore quite natural that on closer investigation all these different faiths are found to be similar. They all teach an immortality of the individual soul; they are more or less dualistic; they show a tendency toward asceticism; they hold fast to the belief in a universal religion, or at least in the universality of religious truths; they proclaim a mediator between God and man, an incarnation of the deity or representative of God on earth, either in the shape of a mythical personality such as Mithras, or the incarnation of a sage such as Socrates, Apollonius of Tyana, or Jesus the Nazarene. This new religion that is preparing itself is really the essence of the sum total of all the pagan religions preceding Christianity in its ideas of the God-man, the Saviour, the remission of sins, the resurrection of the body, the renewal of the world, the establishment of a kingdom of heaven on earth, and kindred hopes. Hence have arisen many pre-Christian movements anticipating such Christian doctrines as the trinity, which is definitely provable in the case of Simon Magus, the existence of wandering preachers like Apollos who taught the Christ and was conversant with the doctrines of "the Lord," without ever having heard of Jesus. Among these prophets of the new religion there were many Jews, who on account of their rigid and iconoclastic monotheism we must assume played a very prominent part, and St. Paul among them succeeded in focusing this worldwide movement upon Jesus. If he had not succeeded in his aspirations, if some other rival sect had succeeded in establishing itself we might have other names, perhaps also other sacred scriptures, but the new religion would have practically become the same in doctrine and ethical ideas. It would have passed through the same phases of dualism and in general outlines would have followed the same course of development. If for instance Apollonius of Tyana had become the deity of the new faith, the Platonic, Neo-Platonic or Stoic writings would have become to us what the Old Testament is now to Christians. If the Mithraists had been victorious, the Zendavesta would have taken the place of the Hebrew scriptures, and our theologians would study the Gathas in place of the prophets. They would look upon Zarathushtra as the great prophet of antiquity who had prepared the way of the saviour.

Professor Smith corroborates this general conception concerning the origin of Christianity, yet he goes beyond it. He establishes in addition some details concerning the very origin of the idea of Jesus as a Nazarene and for the first time shakes our belief in the authenticity of the epistles of St. Paul, which heretofore had been accepted as genuine even by the most radical critics. We might add incidentally that the conservative class of German theologians slowly follow in the wake of the same general tendency. We will call attention to Professor Pfeiderer's distinction between Jesus and Christ, which implies that Christianity as it is interpreted in orthodox quarters is practically a Jesuanity, and that in order to become true Christianity, it would have to overcome the historical error of the identification of Jesus and Christ.

We have watched Professor Smith's publications with great interest, and though we are not prepared to follow him in all details, we are convinced

that he should have a fair hearing, and that his labors will considerably promote the solution of the main problems of New Testament theology.

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DER DOPPELTE STANDPUNKT IN DER PSYCHOLOGIE. Von Mary Whiton Calkins. Leipzig: Von Veit, 1905. For sale by C. A. Köhler & Co., 149 Tremont St., Boston. Pp. 80.

By double standpoint, Prof. Mary W. Calkins does not mean the parallelism of Weber, Fechner, Wundt and others who have made use of the term to express psychical phenomena in physical terms, but the two opposite view-points which are present in psychology. There are two schools: one looks upon soul as a combination of psychic states, and interprets them to be realities of life; while the other assumes the existence of a soul, and interprets those sentiments, volitions, etc., as the manifestations of the soul. It goes without saying that either the soul is, as the traditional soul-conception teaches, an absolute unit; or it is as Wundt says, a unification of units which is not absolute, but the product of organization. *Tertium non datur*. If Professor Calkins attempts, nevertheless, to reconcile the two positions, she does so because she feels that the old traditional view is no longer tenable, and that she has to utilize the data of psychophysics. In fact most of the detailed work of her exposition draws largely upon experimental psychology, which is merely a branch of psychology, and, as it is frequently treated in our laboratories, proves too unsatisfactory to be acceptable as a theory of the soul.

The work of many latter-day psychologists is very insufficient and leaves out of sight some of the most significant features of soul-life, as those features which depend upon character or are experiences of personality as such. A study of their lucubrations, or their experiments, or their expositions, makes one feel like the wanderer, who could not see the woods because of the many trees. Everything is detail, and nowhere is the soul of man as a whole taken into consideration. The truth is that the soul is not a conglomeration of unrelated impulses, but that its unity is the most significant factor in the correlation of the diverse psychic elements that constitute a personality. While we thus support the cause of a monistic psychology we appreciate the significance of the old interpretation, and can very well understand that Professor Calkins does not want to part lightly with some of its most important truths. The result is that she chooses from each side what appeals to her as best.

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DIE ERKENNTNISTHEORIE DER NATURFORSCHUNG DER GEGENWART. Von Dr. H. Kleinpeter. Leipzig: 1905. Pp. xii, 156.

Professor Kleinpeter sums up in this handy little volume the essential features of the modern conception of science, especially modern science, in which the views of Mach, Stallo, Clifford, Kirchhoff, Hertz, Pearson and Ostwald, have been made the foundation of the naturalist's world conception. It is one which discards the revision of the old philosophy, and bases the new philosophy absolutely upon experience. The problems of the book deserve careful and special attention, and we hope that we shall find an opportunity to discuss the difficult points in this new materialism which is at present governing the leading minds of science.